PART B

INSERT DAVIS BACON APPENDIX G

GEOTECHNICAL REPORT

ENVIRONMENTAL IMPACT REPORT – MITIGATION MONITORING PROGRAM

ENVIRONMENTAL COMMITMENT PROGRAM

PROJECT MITIGATION AND MONITORING PLAN

EXHIBIT G – DAVIS-BACON REQUIREMENTS

For the purposes of this Exhibit only, "subrecipient" or "sub recipient" means Recipient as defined in this Agreement.

For the purposes of this Exhibit only, "recipient" or "State recipient" means the State Water Board.

I. Requirements Under the Water Resources Reform and Development Act of 2014 (WRRDA) For Subrecipients That Are Governmental Entities:

If a sub recipient has questions regarding when Davis-Bacon (DB) applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State Water Board at DavisBacon@waterboards.ca.gov or phone (916) 327-7323. The recipient or sub recipient may also obtain additional guidance from DOL's web site at http://www.dol.gov/whd/.

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements.

Under the Water Resources Reform and Development Act of 2014 (WRRDA) -, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund. If a sub recipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the sub recipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Sub recipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the sub recipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The sub recipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the sub recipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the sub recipient.

(ii) If the sub recipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the sub recipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The sub recipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the sub recipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the sub recipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Sub recipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a sub recipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the sub recipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the sub recipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The sub recipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the sub recipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF - financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or FY 2014 Water Resource Reform and Development Act, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in §5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Sub recipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The sub recipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sub recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the sub recipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional timeis necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the sub recipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof. (iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The sub recipient(s) shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

EXHIBIT G – DAVIS-BACON REQUIREMENTS

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the sub recipient, that is, the entity that receives the subgrant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the sub recipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at https://www.dol.gov/whd/forms/index.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the sub recipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sub recipient(s).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or sub contractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and sub recipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility. (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1). (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The sub recipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $25 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The sub recipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section. (b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Sub recipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Sub recipient shall insert in any

such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The sub recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(3), all interviews must be conducted in confidence. The sub recipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The sub recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Sub recipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB. Sub recipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The sub recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The sub recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the sub recipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Sub recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the sub recipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The sub recipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Sub recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/whd/america2.htm.

Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

July 11, 2019

KA Project No. 02215055

Kern Tulare Water District
3000 California Avenue
Bakersfield, California 93308

RE: Geologic and Geotechnical Engineering Investigation
Guzman Reservoir
Kern County, California

Dear Mr. Domingo:

In accordance with your request, we have completed a Geologic and Geotechnical Engineering Investigation for the above-referenced site. The results of our investigation are presented in the attached report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 348-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

DEAN ALEXANDER
NO. 2051
EXP. 9/30/2019

Dean Alexander
Principal Engineer
RCE No. 34274/RGE No. 2051

DA/ljk

GEOLOGIC AND
GEOTECHNICAL ENGINEERING
INVESTIGATION
GUZMAN RESERVOIR
KERN COUNTY, CALIFORNIA

Project No. 02215055
July 11, 2019

Prepared for:
Kern Tulare Water District
3000 California Avenue
Bakersfield, California 93308

Prepared by:
Krazan & Associates, Inc.
215 West Dakota Ave
Clovis, California 93612

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Krazan & ASSOCIATES, INC.

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CONSTRUCTION TESTING & INSPECTION

July 11, 2019

KA Project No. 022-15055

GEOLOGIC GEOTECHNICAL ENGINEERING INVESTIGATION
GUZMAN RESERVOIR
KERN COUNTY, CALIFORNIA

INTRODUCTION

This report presents the results of our Geologic and Geotechnical Engineering Investigation for the Guzman Reservoir in Kern County, California. The development will consist of constructing one reservoir with a 47-foot tall dam. The proposed dams will have earth embankments. The 10 foot tall saddle dam will also be associated with the reservoir. It is planned to obtain the fill soil for dam will be constructed with a uniform soil unit.

The specific purpose of this investigation was to evaluate the geologic and geotechnical conditions of the proposed project area and provide design recommendations. Methods of analysis included site reconnaissance, examination of adjacent property, exploratory test holes and sampling, laboratory testing of selected soil samples, literature research, engineering, and geologic evaluation of resulting data. Conclusions and recommendations concerning geological and geotechnical engineering aspects of the project site are provided in this report.

SITE DESCRIPTION

The proposed reservoir site is located on the south side of Highway 65, approximately 1,000 feet north of Hart Avenue in Kern County, California. The proposed reservoir area is irregular in shape and encompasses approximately 30 acres. The Vicinity Map is presented in Figure 1.

The proposed reservoir site consists primarily of rolling native grass pasture land with elevations ranging from 650 to 700 feet above mean sea level.

SITE MAP	**Scale:** NTS	**Date:** 08/2015	Krazan **GEOTECHNICAL ENGINEERING**
GUZMAN RESERVOIR **HIGHWAY 65** **KERN COUNTY, California**	**Drawn by:** KW	**Approved by:** DA	
	Project No. 022-15055	**Figure No.** 1	

This site has rolling terrain with approximately 50 feet of relief. Maximum slopes are on the order of 15 degrees. The site is covered by native grasses.

Orange groves are located north, west and south of the site. Native vegetation is located east of Highway 65.

REGIONAL GEOLOGY

The subject property is located along the eastern margin of the southern San Joaquin Valley portion of the Great Valley Geomorphic Province of California. The San Joaquin Valley is bordered to the north by the Sacramento Valley portion of the Great Valley, to the east by the Sierra Nevada, to the west by the Coast Ranges, and to the south by the Transverse Ranges. The San Joaquin sedimentary basin is separated from the Sacramento basin to the north by the buried Stockton arch and associated Stockton Fault. The buried Bakersfield arch near the south end of the valley separates the relatively small Maricopa-Tejon subbasin at the south end of the San Joaquin basin from the remainder of the basin. The 450-mile long Great Valley is an asymmetric structural trough that has been filled with a prism of Mesozoic and Cenozoic sediments up to 5 miles thick.

The Sierra Nevada, located east of the San Joaquin Valley, is gently southwesterly tilted fault block comprised of igneous and metamorphic rocks of pre-Tertiary age that comprise the basement beneath the San Joaquin Valley. The Coast Ranges, located west of the San Joaquin Valley, are comprised of folded and faulted sedimentary and metasedimentary rocks of Mesozoic and Cenozoic age.

The Kern River and Kaweah River are the principal rivers in the area. Alluvial fans formed by these rivers are the predominant geomorphic features in the project vicinity. The area of the subject site is characterized by low alluvial fans and plains, which constitute a belt of coalescing alluvial fans of low relief between the dissected uplands, adjacent to the Sierra Nevada and the valley trough. This has resulted in a rather flat topography in the vicinity of the project site. The site is comprised of alluvial deposits which are mostly sands silts and clays.

The general area south of the subject site is known for significant oil and gas production. Three small-to medium-size oil fields are located in the vicinity: the Jasman, the West Jasman, and the Trico Oil Fields. The project site is also located north of the areas designated as the Poso Creek Field and Kern Front Field.

These oil fields were discovered in the 1920's, but it was not until the middle 1930s that production began to increase significantly.

A Regional Geologic Map and Regional Geologic Cross-Section are presented on Figures 2 and 3.

Lithology

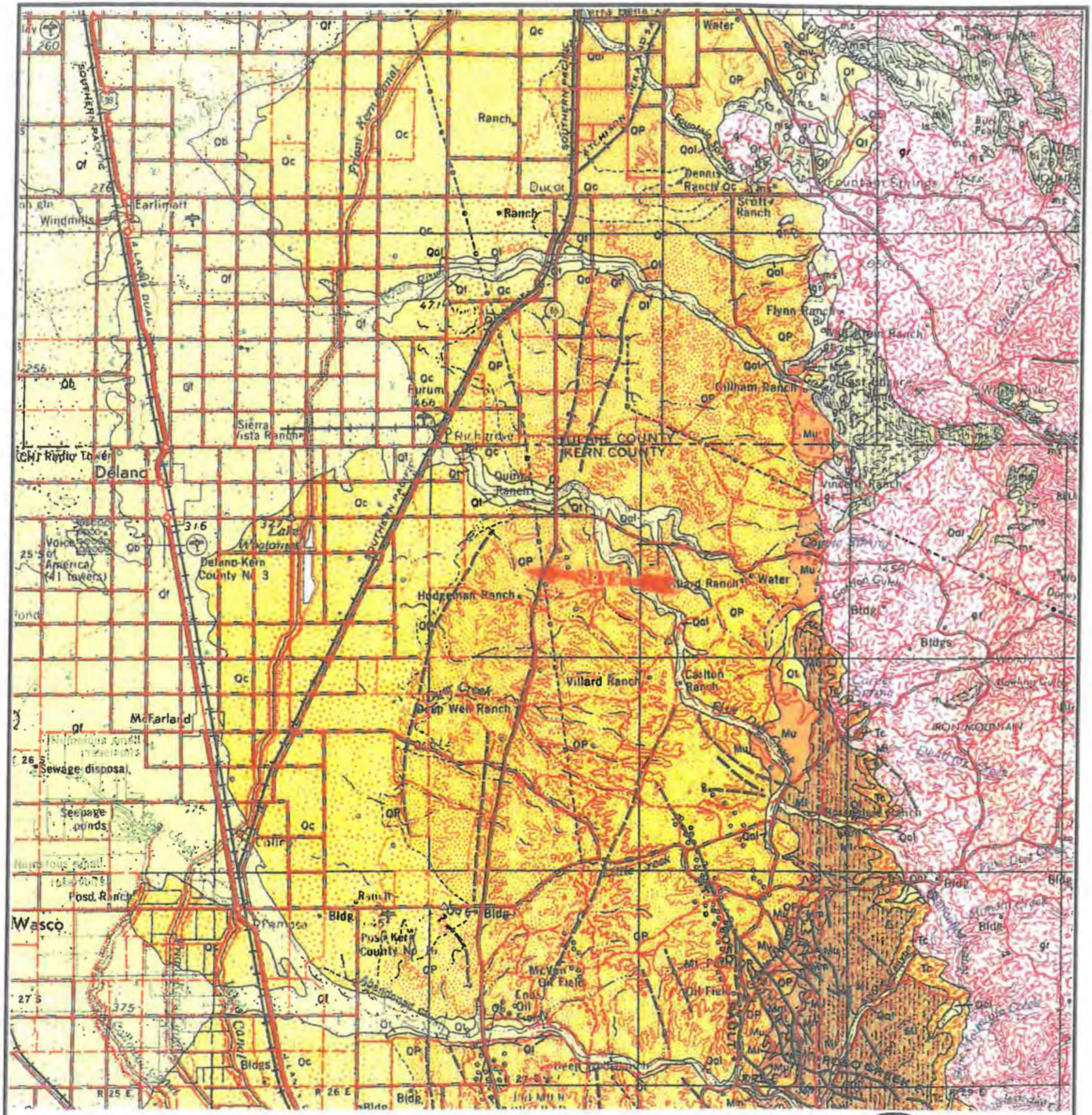
The thick accumulation of deposits within the San Joaquin Valley range in age from Jurassic to Holocene and include both marine and continental rocks and deposits. The 1964 Geologic Map of California, Bakersfield Sheet, indicates that the near-surface deposits in area of the subject site are identified as Plio-Pleistocene non-marine sediments consisting of sands, silts, and clays.

The subsurface information obtained in this study indicates that the surface and near-surface soil deposits at the subject site generally consist of sandy silts, silty sands, and sands. These observed deposits are consistent with those mapped in the area, and are further described in the Soil Profile and Subsurface Conditions section of this report.

Structure and Faults

The general area of the subject site is underlain by a homoclinal series of Cenozoic deposits dipping 4 degrees to 6 degrees to the southwest toward the center of the San Joaquin Valley. The contact between the Cenozoic and basement rocks dips nearly 8 degrees southwest, or at a slightly greater inclination than does the on-lapping homoclinal Cenozoic sequence. A slightly elevated basement structure, the Bakersfield Arch is located in the vicinity of the site. This structure is considered to have controlled sedimentation within the far southern portion of the valley.

As shown in the Fault Map in Figure 4, The south end of the San Joaquin Valley is bordered on the west, south, and east by three major fault systems: the San Andreas, Garlock, and Breckenridge-Kern Canyon faults, respectively. All three of these faults zone appear to be directly related to the uplifting of the mountain ranges in which they are located and the downwarping of the intermediate land mass which constitutes the San Joaquin Valley portion of the Great Valley Geosyncline. The forces which have resulted in the formation of these major fault zones and the continuing movements along them have had great influence locally in the valley floor in the form of folding and faulting of the thick section of sedimentary beds and the underlying basement complex. Deformation of the sedimentary rocks in the area has not been restricted to faulting. Localized folding had also occurred within the geosyncline forming entrapments for oil and gas accumulations.



REGIONAL GEOLOGIC MAP

NORTH

0 4 8

SCALE IN MILES (±)

FROM:
GEOLOGIC MAP OF CALIFORNIA–BAKERSFIELD SHEET OLAF P. JENKINS EDITION, COMPILATION BY ARTHUR R. SMITH, 1964

GEOTECHNICAL ENGINEERING INVESTIGATION
GUZMAN RESERVIOR
HIGHWAY 65
KERN COUNTY, CA

Scale: AS SHOWN
Date: 8/15
Drawn by: DA
Approved by: DA
Project No. 022–15055
Figure No. 2

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CENOZOIC	QUATERNARY	Recent	Qs	Dune sand			
			Qal	Alluvium			
			Qsc	Stream channel deposits	GREAT VALLEY	Qrv	Recent volcanic: Qrv^r —rhyolite; Qrv^a —andesite; Qrv^b —basalt; Qrv^p —pyroclastic rocks
			Qf	Fan deposits			
			Qb	Basin deposits			
			Qst	Salt deposits			
			Ql	Quaternary lake deposits			
			Qg	Glacial deposits			
			Qt	Quaternary nonmarine terrace deposits			
		Pleistocene	Qm	Pleistocene marine and marine terrace deposits		Qpv	Pleistocene volcanic: Qpv^r —rhyolite; Qpv^a—andesite; Qpv^b —basalt; Qpv^p —pyroclastic rocks
			Qc	Pleistocene nonmarine			
			QP	Plio-Pleistocene nonmarine		✻	Quaternary and/or Pliocene cinder cones
	TERTIARY	Pliocene	Pc	Undivided Pliocene nonmarine			
			Puc	Upper Pliocene nonmarine			
			Pu	Upper Pliocene marine		Pv	Pliocene volcanic: Pv^r —rhyolite; Pv^a—andesite; Pv^b —basalt; Pv^p —pyroclastic rocks
			Pmlc	Middle and/or lower Pliocene nonmarine			
			Pml	Middle and/or lower Pliocene marine			
		Miocene	Mc	Undivided Miocene nonmarine			
			Muc	Upper Miocene nonmarine			
			Mu	Upper Miocene marine		Mv	Miocene volcanic: Mv^r —rhyolite: Mv^a —andesite; Mv^b —basalt; Mv^p —pyroclastic rocks
			Mmc	Middle Miocene nonmarine			
			Mm	Middle Miocene marine			
			Ml	Lower Miocene marine			
		Oligocene	Φc	Oligocene nonmarine		Φv	Oligocene volcanic: $Φv^r$—rhyolite; $Φv^a$ —andesite ; $Φv^b$—basalt; $Φv^p$—pyroclastic rocks
			Φ	Oligocene marine			
		Eocene	Ec	Eocene nonmarine		Ev	Eocene volcanic: Ev^r —rhyolite; Ev^a —andesite; Ev^b —basalt; Ev^p —pyroclastic rocks
			E	Eocene marine			
		Paleocene	Epc	Paleocene nonmarine			
			Ep	Paleocene marine			
		Undivided	QTc	Cenozoic nonmarine		QTv	Cenozoic volcanic: QTv^r—rhyolite; QTv^a—andesite; QTv^b —basalt; QTv^p —pyroclastic rocks
			Tc	Tertiary nonmarine		Tg^r	Tertiary granitic rocks
			Tl	Tertiary lake deposits			Tertiary intrusive (hypabyssal) rocks: Ti^r—rhyolite; Ti^a —andesite; Ti^b —basalt
				Tertiary marine			Tertiary volcanic: Tv^r —rhyolite; Tv^a —andesite; Tv^b —basalt; Tv^p —pyroclastic rocks

REGIONAL GEOLOGIC MAP

EXPLANATION

FROM:
GEOLOGIC MAP OF CALIFORNIA-BAKERSFIELD SHEET OLAF P. JENKINS EDITION, COMPILATION BY ARTHUR R. SMITH, 1964

GEOTECHNICAL ENGINEERING INVESTIGATION
GUZMAN RESERVIOR
HIGHWAY 65
KERN COUNTY, CA

Scale: AS SHOWN	Date: 8/15
Drawn by: DA	Approved by: DA
Project No. 022-15055	Figure No. 2a

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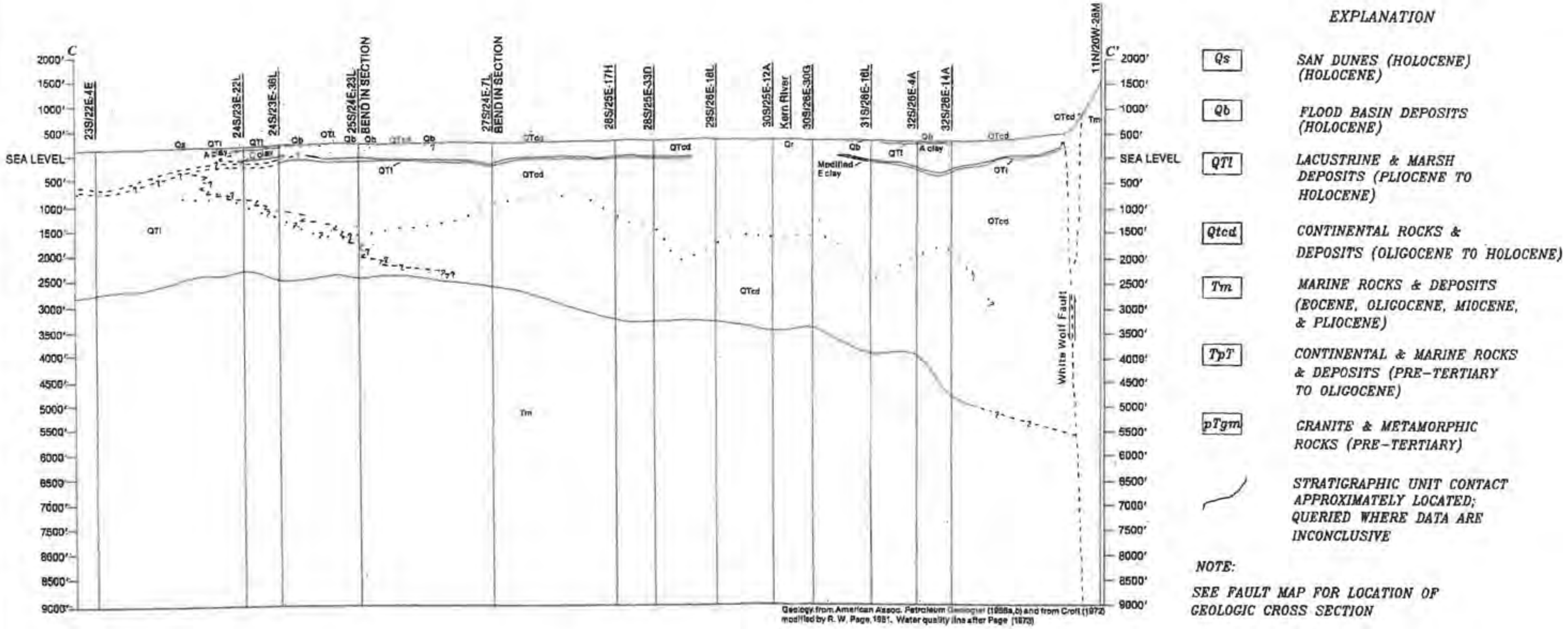


Geology from American Assoc. Petroleum Geologist (1958a,b) and from Croft (1972) modified by R. W. Page, 1981. Water quality line after Page (1973)

NOTE:

SEE FAULT MAP FOR LOCATION OF GEOLOGIC CROSS SECTION

REGIONAL GEOLOGIC CROSS-SECTION SHOWING THE SAN JOAQUIN VALLEY

SCALE

HORIZONTAL: 1" = 7.0 MILES
VERTICAL: 1" = 2,400 FEET

NOTE:

SEE FAULT MAP FOR LOCATION OF GEOLOGIC CROSS-SECTION.

GEOTECHNICAL ENGINEERING INVESTIGATION GUZMAN RESERVOIR HIGHWAY 165	Scale: AS SHOWN	Date: 08/15	Krazan ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SPECIALISTS
	Drawn by: DA	Approved by: DA	
KERN COUNTY CA	Project No. 022-15055	Figure No. 3	*Offices Serving the Western United States*

Adjacent to the San Joaquin Valley, the Sierra Nevada and Coast Ranges are geologically young mountain ranges that possess active and potentially active fault zones. Major active faults and fault zones occur at some distance to the east, west, and south of the project site. The Sierra Nevada and Owens Valley Fault Zones bound the eastern edge of the Sierra Nevada block approximately 60 and 75 miles east of the site, respectively. Numerous active faults are present within the San Joaquin Valley, San Emigdio Mountains, and Tehachapi Mountains south of the site including the White Wolf, Pleito Thrust, Big Pine, and Garlock Faults.

The White Wolf Fault (responsible for a 1952 earthquake that caused extensive damage in the Bakersfield area) is located in the tectonically active Tehachapi Mountains as the southerly terminus of the valley, approximately 50 miles south of the subject site.

Numerous active faults are present within the central Coast Ranges west of the site including the San Andreas Fault located approximately 53 miles west of the subject site. The fault is considered active and is of primary concern in evaluating seismic hazards throughout western Kings County. The 684-mile-long San Andreas Fault Zone is the principal element of the San Andreas Fault system, a network of faults with predominately dextral strike-slip displacement that collectively accommodates the majority of relative north-south motion between the North America and Pacific plates. The San Andreas Fault zone is the most extensively studied fault in California, and perhaps the world. The San Andreas Fault Zone is considered to be the Holocene and historically active dextral strike-slip fault that extends along most of coastal California from its complex junction with the Mendocino Fault zone on the north, southwest to the northern Transverse Range and inland to the Salton Sea, where a well defined zone of seismicity transfers the slip to the Imperial fault along a right-releasing step.

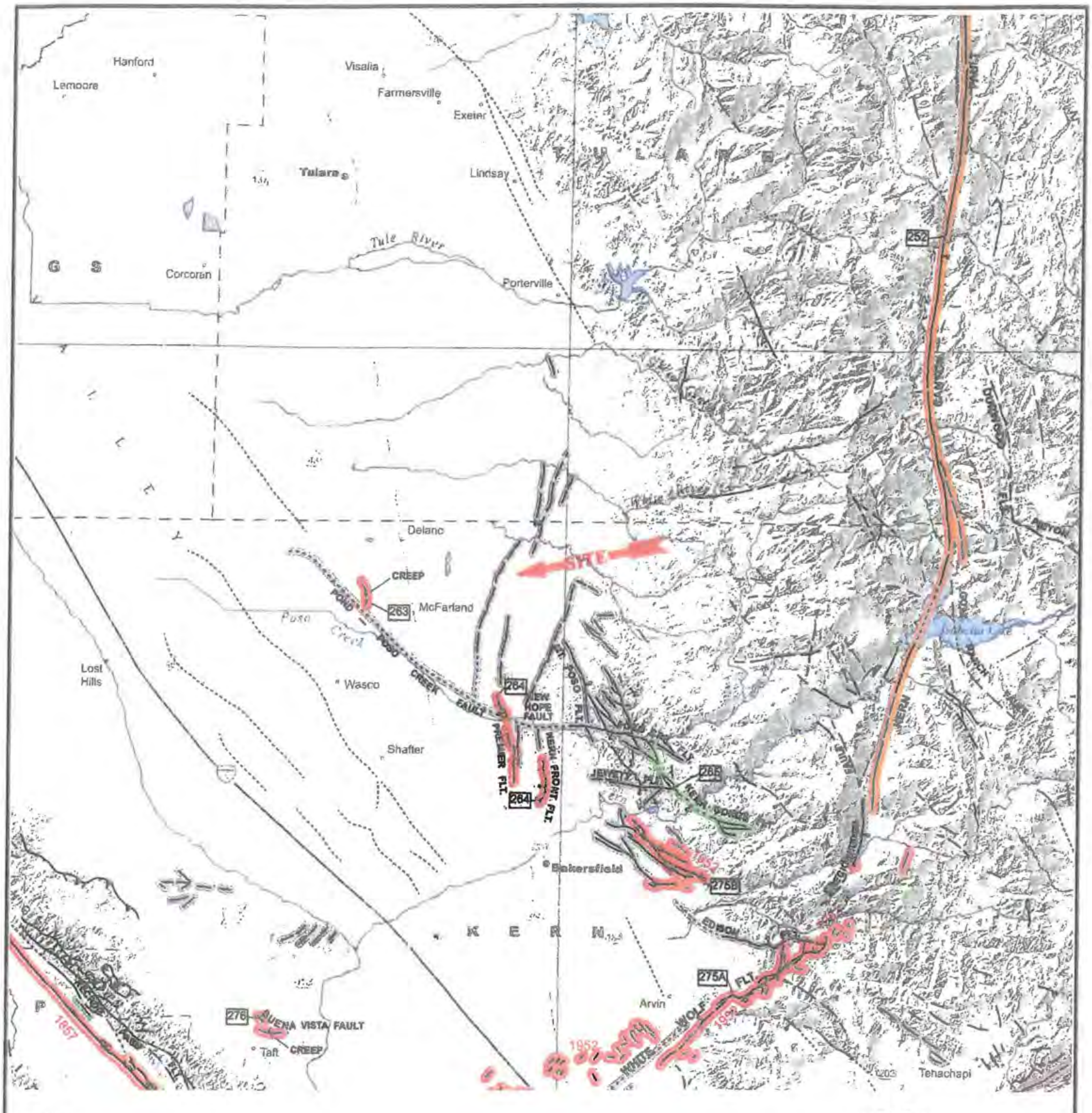
Two major surface-rupturing earthquakes have occurred on the San Andreas Fault in historic time: the 1857 Forth Tejon and 1906 San Francisco earthquakes. Additional historic surface rupturing earthquakes include the unnamed 1812 earthquake along the Mojave section and the northern part of the San Bernardino Mountains section, and a large earthquake in the San Francisco Bay area that occurred in 1838 that was probably on the Peninsula section. Historic fault creep rates are as high as 32 millimeters per year for the 82-mile-long creeping section in central California with creep rates gradually tapering to zero at the northwestern and southeastern ends of the section.

One of the nearest seismotectonic sources is the Great Valley Fault Zone (Coast Ranges-Central Valley boundary zone), located approximately 51 miles west of the site. The Great Valley Fault zone is the geomorphic boundary of the Coast Ranges and the Central Valley and is underlain by a 300-mile long seismically active fold and thrust belt that has been the source of recent earthquakes, such as the 1983 magnitude 6.5 Coalinga and the 1985 magnitude 6.1 Kettleman Hills earthquakes. Nearly the entire thrust system is concealed or "blind". The basal detachment of this thrust system dips at a shallow angle to the west. East-directed thrusting over ramps in the detachment and west-directed thrusting on backthrusts are responsible for the uplift along the eastern range front of the Coast Ranges. Based on earthquake focal mechanisms, movement on the thrust zone is generally perpendicular to the strike of the geomorphic boundary and trend of the San Andreas Fault system. Shortening along the geomorphic boundary is driven by a component of the Pacific-North American Plate motion that is normal to the plate boundary. The Great Valley Fault Zone is considered a dominant seismic feature with potential for affecting the subject site.

Tensional forces resulting in normal faults are reported to be related to crustal stress relief in the southeast portion of the San Joaquin Valley. Numerous relatively short, normal faults traverse this region. Creep activity is the prominent mode of slip on those faults in this region that are active. These movements have continued on an intermittent basis from the early Miocene to Recent time. This faulting is directly related to and controls the accumulation of oil in several oil fields within the easterly portion of the valley. Most authors agree that current creep movements can be ascribed to subsidence promoted by extensive withdrawal of petroleum, and in some cases, groundwater. Those faults considered to be active in the southern valley are the Pond, New Hope, Premier, and Kern Front Faults located 10 to 12 miles south and west of the subject site.

The Kern Front, Premier and New Hope Faults, are actively creeping westerly-dipping normal faults in oil-producing areas. The Buena Vista Fault, also located within a nearby oil producing area, is indicated to be a north-dipping thrust fault. Recent aseismic movement along these pre-existing faults is considered to be related to oil field fluid withdrawal. In addition, numerous unnamed faults are mapped within the oil fields in the vicinity of the site. The majority of the mapped faults associated with the oil fields, do not extend through the Kern River Formation to the surface and have been mapped based on extensive subsurface exploration associated with the oil industry. The Pond Fault is a relatively minor, actively creeping west-dipping to vertical normal fault which is considered to be due to differential subsidence caused by groundwater withdrawal.

The Sierra Nevada and Owens Valley Fault Zones bound the eastern edge of the Sierra Nevada block more than 60 miles east of the site.



FAULT MAP

NOTES:

PREPARED FROM THE C.G.S. "FAULT ACTIVITY MAP OF CALIFORNIA" JENNINGS AND BRYANT, 2010

FAULT TRACES ON LAND ARE INDICATED BY SOLID LINES WHERE WELL LOCATED, BY DASHED LINES WHERE CONCEALED BY YOUNGER ROCKS OR BY LAKES OR BAYS. FAULT TRACES ARE QUERIED WHERE CONTINUATION OR EXISTENCE IS UNCERTAIN.

NORTH

0 12 24

SCALE IN MILES (±)

GEOTECHNICAL ENGINEERING INVESTIGATION GUZMAN RESERVOIR HIGHWAY 65	Scale: AS SHOWN	Date: 8/15	Krazan ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SPECIALISTS *Offices Serving the Western United States*
	Drawn by: DA	Approved by: DA	
KERN COUNTY, CA	Project No. 022-15055	Figure No. 4	

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:

(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.

(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.

(c) displaced survey lines.

A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

Date bracketed by triangles indicates local fault break.

No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occured that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

NOTES:

PREPARED FROM THE C.G.S. "FAULT ACTIVITY MAP OF CALIFORNIA JENNINGS AND BRYANT, 2010

FAULT TRACES ON LAND ARE INDICATED BY SOLID LINES WHERE WELL LOCATED, BY DASHED LINES WHERE CONCEALED BY YOUNGER ROCKS OR BY LAKES OR BAYS. FAULT TRACES ARE QUERIED WHERE CONTINUATION OR EXISTENCE IS UNCERTAIN.

FAULT MAP

EXPLANATION

GEOTECHNICAL ENGINEERING INVESTIGATION GUZMAN RESERVOIR HIGHWAY 65	Scale: AS SHOWN	Date: 8/15
	Drawn by: DA	Approved by: DA
KERN COUNTY, CA	Project No. 022-15055	Figure No. 4a

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The northwest trending Clovis Fault and two unnamed related faults are believed to be located approximately 25 to 70 miles east to northeast of the subject site, extending from an area just south of the San Joaquin River to a few miles south of Francher Creek and from just south of the City of Dinuba to just south of the City of Porterville. These faults are considered pre-quaternary faults with no recognized Quaternary displacement. These faults are not necessarily inactive.

GEOLOGIC HAZARDS

Fault Rupture Hazard Zones in California

The Alquist-Priolo Geologic Hazards Zones Act went into effect in March, 1973. Since that time, the act has been amended 10 times (Hart, 1994). The purpose of the Act, as provided in DMG Special Publication 42 (SP 42), is to prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." The act was renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1994, and at that time, the originally designated "Special Studies Zones" was renamed the "Earthquake Fault Zones."

The subject site does not lie on a Fault Rupture Hazard Zones Map, and accordingly, the site is not within a Fault-Rupture Hazard Zone. The nearest zoned fault is a portion of the Premier Fault located more than 10 miles south of the subject site.

Seismic Hazard Zones in California

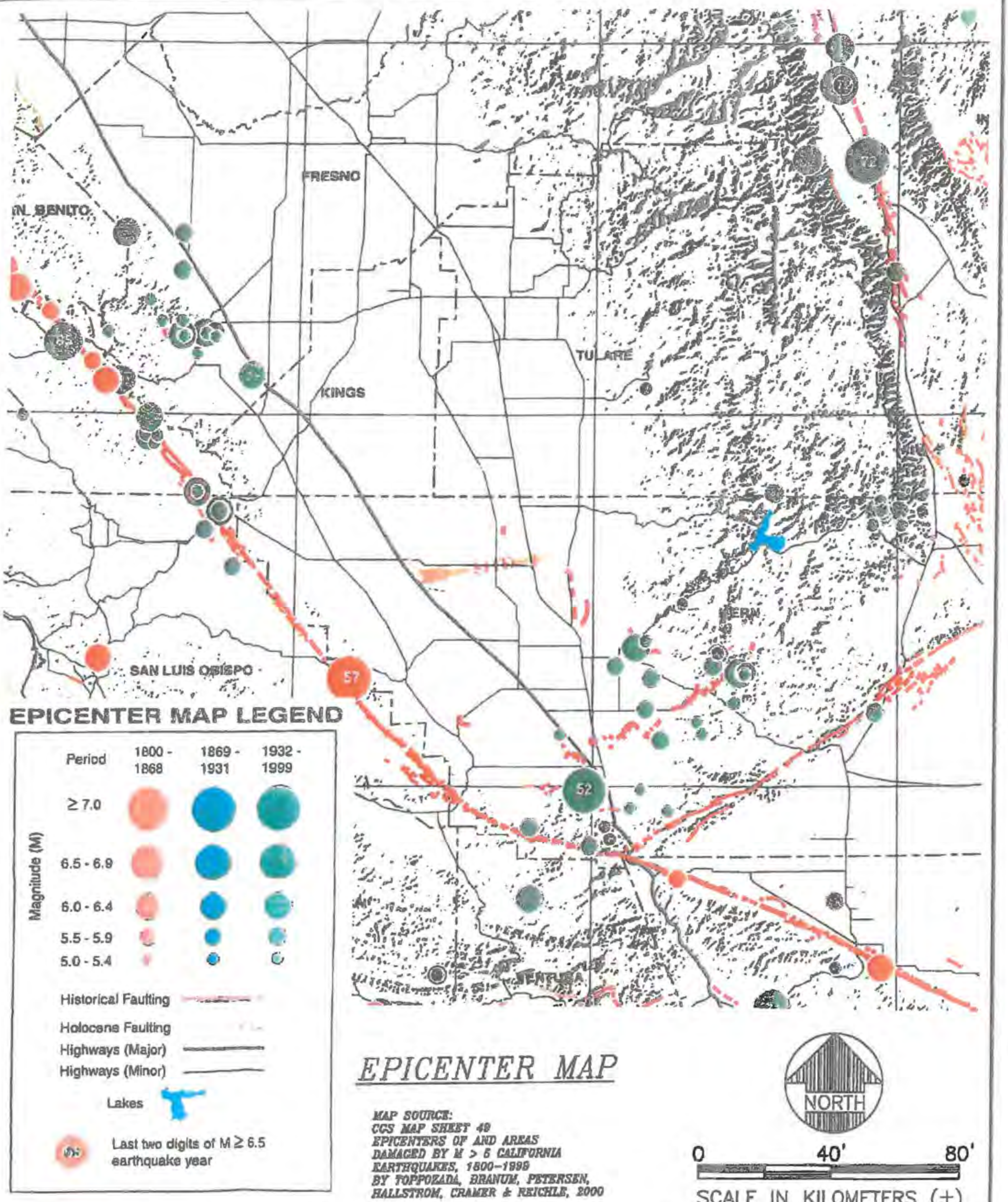
In 1990, the California State Legislature passed the Seismic Hazard Mapping Act to protect public safety from the effects of strong shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. The Act requires that the State Geologist delineate various seismic hazards zones on Seismic Hazards Zones Maps. Specifically, the maps identify areas where soil liquefaction and earthquake-induced landslides are most likely to occur. A site-specific geotechnical evaluation is required prior to permitting most urban developments within the mapped zones. The Act also requires sellers of real property within the zones to disclose this fact to potential buyers. The area of the subject site is not included on any of the maps released to date. It is not known whether the subject site will be within a seismic hazard zone on a future map.

Historic Seismicity/Earthquake Epicenter Distribution

The subject site area has historically experienced a low to moderate degree of seismicity. A listing of historic earthquakes with magnitudes greater than 4.0 within approximately 50 miles of the subject site was obtained from the comprehensive California Geological Survey computerized earthquake catalog for the State of California, the Townley and Allen (1939) catalog and the U.S. Geological Survey Earthquake Data Base System. In addition, a listing was obtained for all historic earthquakes with magnitudes greater than 5.0 within approximately 100 miles of the site. The listings include the date, time, location, depth, magnitude, and intensity all recorded events within the search radius between 1800 and 2014. A review of the literature for pre-1900 earthquakes (Toppozada, 1991) does not reveal any significant recorded seismic events in the vicinity of the subject site prior to the period covered by the above listing.

A plot of epicenters associated with historic earthquakes in the region of the site with magnitudes greater than 5 is shown on Figure 5, Epicenter Map. The earthquake data indicates that 215 events with magnitudes greater than 4.0 occurred within 50 miles of the subject site between 1800 and 2016. None of the listed events occurred within 17 miles of the site. The data indicates that 133 events exceeded magnitudes 5.0 within 100 miles of the subject site. The nearest listed event occurred approximately 17.7 miles southeast of the site in 1926 with a magnitude of 5.0. Twenty-one of the listed earthquakes with magnitudes greater than 5.0 occurred within 50 miles of the site. Numerous earthquakes are listed with magnitudes between 5.0 and 6.0 beyond about 40 miles of the site. Two events were recorded with magnitudes greater than 6.0 within 50 miles of the site. The largest magnitude found in the search radius was 7.9 occurring January 9, 1857.

The geologic literature indicates that groundshaking of VIII intensity (Modified Mercalli Scale) was felt at the subject site from the 1857 Fort Tejon Earthquake and the 1952 Arvin-Tehachapi Earthquake. These are the largest known earthquake events to have affected the project vicinity. The most recent earthquake significant to the site area was the seismic event which occurred on July 21, 1952. A significant number of the listed historic earthquakes occurred in 1952 and are considered related to the Arvin-Tehachapi earthquake of July 21, 1952. This magnitude 7.7 event affected all of Kern County as well as parts of Los Angeles and Santa Barbara Countries. The earthquake took place near Wheeler Ridge on the White Wolf Fault, located approximately 51 miles southeasterly of the subject site. Vertical displacements of as much as three feet occurred at the fault line. Destruction in the communities of Arvin and Tehachapi was extensive; the quake caused numerous landslides and damaged highways, bridges, and railroads. Damage to Bakersfield from the main shock was slight, however, on July 29 and August 5, 1952, aftershocks generated just east of Bakersfield produced a great deal of damage to older buildings. Estimated average



EPICENTER MAP

MAP SOURCE:
CGS MAP SHEET 49
EPICENTERS OF AND AREAS
DAMAGED BY M > 5 CALIFORNIA
EARTHQUAKES, 1800–1999
BY TOPPOZADA, BRANUM, PETERSEN,
HALLSTROM, CRAMER & REICHLE, 2000

GEOTECHNICAL ENGINEERING INVESTIGATION
GUZMAN RESERVOIR
HIGHWAY 65
KERN COUNTY CA

Scale: AS SHOWN
Date: 08/15
Drawn by: DA
Approved by: DA
Project No. 022–15055
Figure No. 5

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value of the maximum bedrock accelerations from the 1952 events are about 0.13 gravity (g) at the subject site.

Geologic Subgrade

Information obtained from the geologic literature, as well as data from the above-described site exploration, indicate the general soil profile at the site consists predominately of medium dense to very dense clayey sands, silty sands with clay, sandy clays, and relatively clean sands. Assuming that any loose surface soil and the site are removed and recompacted as recommended in our Geotechnical Engineering Investigation, the geologic subgrade of the site can be conservatively approximated as "stiff soil". A Joyner-Boore Class C subgrade classification is considered appropriate for the soil profile and corresponds with a National Earthquake Hazard Reduction Program (NEHRP) (BSSC, 1994) Site Class D. The site class definition from the 2013 California Building Code that is most consistent with the site conditions is Site Class D.

Seismic Parameters – 2016 California Building Code

The Site Class per Section 1613 of the 2016 California Building Code (2016 CBC) and Table 20.3-1 of ASCE 7-10 is based upon the site soil conditions. It is our opinion that a Site Class D is most consistent with the subject site soil conditions. For seismic design of the structures based on the seismic provisions of the 2016 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Section 1613.3.2
Site Coefficient F_a	1.188	Table 1613.3.3 (1)
S_s	0.780	Section 1613.3.1
S_{MS}	0.926	Section 1613.3.3
S_{DS}	0.618	Section 1613.3.4
Site Coefficient F_v	1.795	Table 1613.3.3 (2)
S_1	0.303	Section 1613.3.1
S_{M1}	0.543	Section 1613.3.3
S_{D1}	0.362	Section 1613.3.4

Shear Wave Velocity

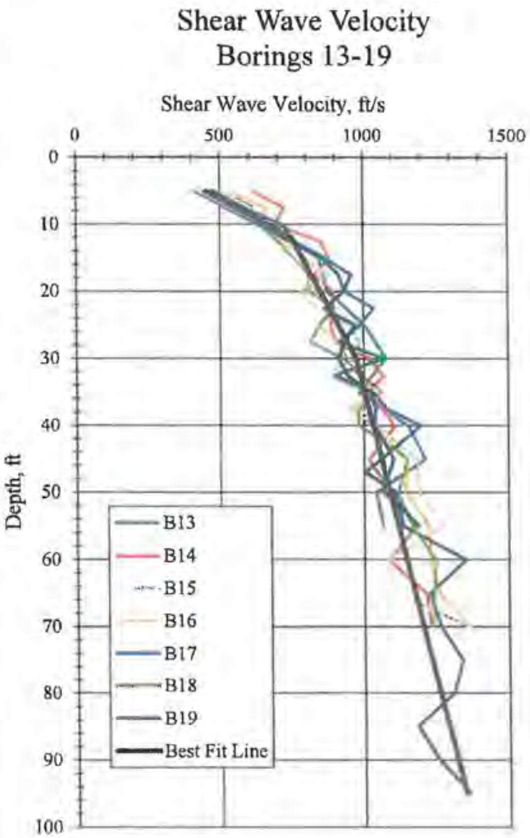
The shear wave velocity profile for the site was developed using the empirical correlation presented in the "Guidelines for Estimation of Shear Wave Velocity" by Bernard R. Wair, Jason T. DeJong, and Thomas Shantz published by PEER in December 2012. The correlation is based on N_{60} blowcounts, vertical effective stress, and geologic age of the soil. Shear wave velocities were calculated for each boring and plotted versus depth. A best fit line for V_{S30} was used for an estimation of the shear wave velocity in top 30

Shear Wave Velocity for Quaternary Soils

Guzman Reservoir

Example calculations for an individual boring

Depth (ft)	USCS	Thickness, d (ft)	Thickness, d (m)	N_{60}	σ'_{v0} (pcf)	σ'_{v0} (kPa)	V_S (m/s)	V_S (ft/s)
5	SC	6.25	1.9	18.5	580	28	148	484
7.5	SC	2.5	0.8	27.1	889	43	178	583
10	SC	2.5	0.8	49.9	1197	57	219	718
12.5	SC/CL	3.75	1.1	50.0	1506	72	231	758
15	SM	1.25	0.4	74.2	1815	87	264	866
17.5	SM	2.5	0.8	98.4	2123	102	292	958
20	SW-SM	2.5	0.8	77.0	2432	116	285	934
22.5	SM	2.5	0.8	107.0	2740	131	316	1036
25	SM	3.75	1.1	78.5	3049	146	301	988
27.5	SW-SM	1.25	0.4	51.4	3358	161	279	917
30	SW-SM	3.75	1.1	92.7	3666	176	327	1071
32.5	SM	1.25	0.4	39.9	3975	190	274	899
35	SM	3.75	1.1	67.1	4284	205	314	1031
37.5	SC	2.5	0.8	77.0	4592	220	330	1081
40	SM	3.5	1.1	112.7	4901	235	365	1198
47	SM	5	1.5	44.2	5765	276	306	1003
50	SW-SM	4	1.2	64.2	6136	294	338	1108
55	SM	7.5	2.3	64.2	6753	323	345	1133
60	ML	5	1.5	94.2	7370	353	412	1352
65	SM	2.5	0.8	77.0	7987	382	374	1228
70	SM	7.5	2.3	81.3	8605	412	386	1265
75	ML	5	1.5	58.5	9222	442	408	1340
80	SM	2.5	0.8	82.7	9839	471	399	1310
85	SM	5	1.5	50.0	10457	501	361	1183
90	SM	5	1.5	61.3	11074	530	383	1256
95	SM	5.9252	1.8	82.7	11691	560	415	1363



V_S Calculations *(as recommended in Reference 1 for SPT)*

Clays & Silts: $V_S = 26*N_{60}^{0.17}*\sigma'_{V0}^{0.32}*ASF$

Sands: $V_S = 30*N_{60}^{0.23}*\sigma'_{V0}^{0.23}*ASF$

σ'_V measured in kPa

ASF - Pleistocene

Clays & Silts	1.12
Sands	1.17

V_{S30} Calculation

$V_{S30} = 30/\Sigma(d/V_S)$ (at best fit line)

V_{S30}= **339 m/s**

1113 ft/s

Note: The thickness, d, to which each blowcount is applied assumes the blowcounts are evenly distributed throughout its respective layer.

References:

1) Guidelines for Estimation of Shear Wave Velocity. Bernard R. Wair, Jason T. DeJong, and Thomas Shantz. PEER 2012/08, December 2012.

2) Geologic Map of California - Bakersfield, Sheet Olaf P. Jenkins Edition, Compilation by Arthur R. Smith, 1964

Figure No. 6

meters. Example calculations for an individual boring is presented in Figure 6. V_{S30} was calculated to be 339 m/s (1,113 ft/s), which meets the specifications for Site Class D.

Soil Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs in soils such as sand in which the strength is purely friction. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic event.

To evaluate the liquefaction potential of the site, the following items were evaluated:

1. Groundwater depth;
2. Soil type;
3. Relative density;
4. Initial confining pressure;
5. Intensity and duration of groundshaking.

The soils encountered within a depth of 50 feet on the project site predominately consist of loose to very dense silty sands, sandy silts, clayey sand and sandy clay. Groundwater was not encountered within the soil borings advanced during subsurface exploration.

The potential for soil liquefaction during a seismic event was evaluated using the LIQUEFYPRO computer program (Version 5.1c) developed by CivilTech Software. For the analysis, a maximum earthquake magnitude of 7.81 was used. A peak horizontal ground surface acceleration of 0.38g with a 2% probability of exceedance in 50 years was considered conservative and appropriate for the liquefaction analysis. A groundwater depth of zero was used for the analysis since the site will be a reservoir. The computer analysis indicates that soils above a depth of 75 feet are non-liquefiable due to the dense nature of the soil. The analysis also indicates that the total and differential seismic induced settlement is not anticipated to exceed ½ inch and ¼ inch, respectively. Therefore, it is not anticipated that liquefaction will have a significant effect on the proposed development. Accordingly, the liquefaction potential at the site is considered very low and measures to mitigate liquefaction potential are not necessary.

Due to the relatively low levels of expected groundshaking at the site, the density of the native soil deposits, and the recommendation that all loose soil within proposed embankment areas be excavated and recompacted, liquefaction is not considered a viable geologic hazard at the subject site.

Seismic Settlement

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on the nature of the subsurface materials, the plan to excavate and recompact the upper soils within the proposed embankment area and the relatively low to moderate seismicity of the region, we would not expect seismic settlement to represent a significant geologic hazard to the site provided that the recommendations of our referenced Geotechnical Engineering Investigation are followed.

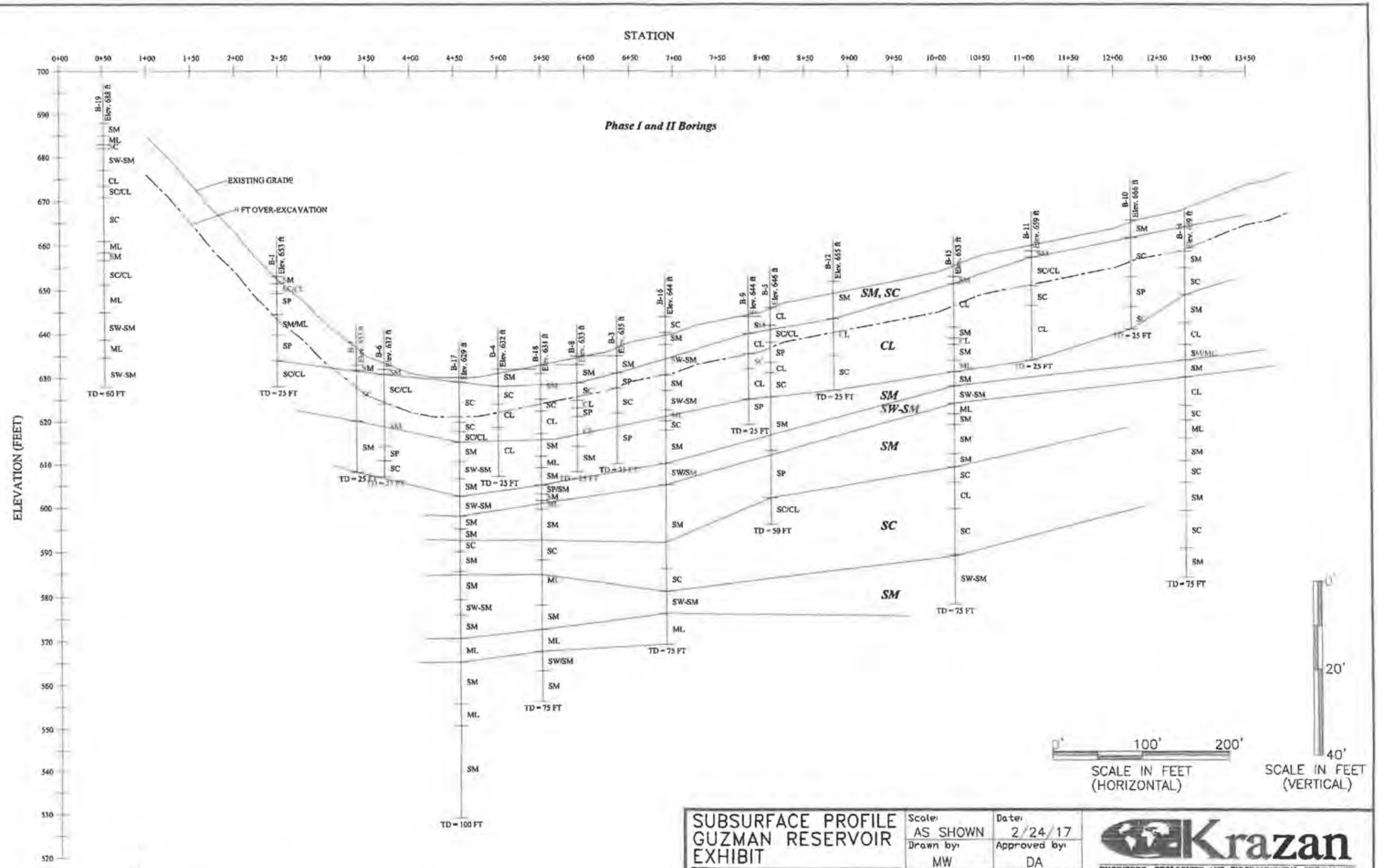
FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling 19 borings to depths ranging from 25 to 100 feet below existing grade using a truck-mounted drill rig. In addition 35 test pits to a depth of 10 feet were placed on the site. The boring and test pit locations are shown on attached Site Map. During drilling operations, penetration tests performed at regular intervals to evaluate the soil consistency and obtain information regarding engineering properties of the subsoils. Soil samples were obtained for laboratory testing. The soils were continuous examined and visually classified in accordance with USCS.

Laboratory tests were performed on selected soil samples to evaluate the physical characteristics and engineering properties. The Log of Boring and Test Pits are provided in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings the subsurface soil conditions encountered appeared to be typical of those found in geologic region of the site. In general the upper soils consist of 12 to 24 inches of very loose to loose silty sand with clay. These surface soils have low strength characteristics and are moderately compressible when saturated.



Note: Elevations based on NAVD88

SUBSURFACE PROFILE
GUZMAN RESERVOIR
EXHIBIT

KERN COUNTY, CA

Scale:	Date:
AS SHOWN	2/24/17
Drawn by:	Approved by:
MW	DA
Project No.	Figure No.
022-15055	7

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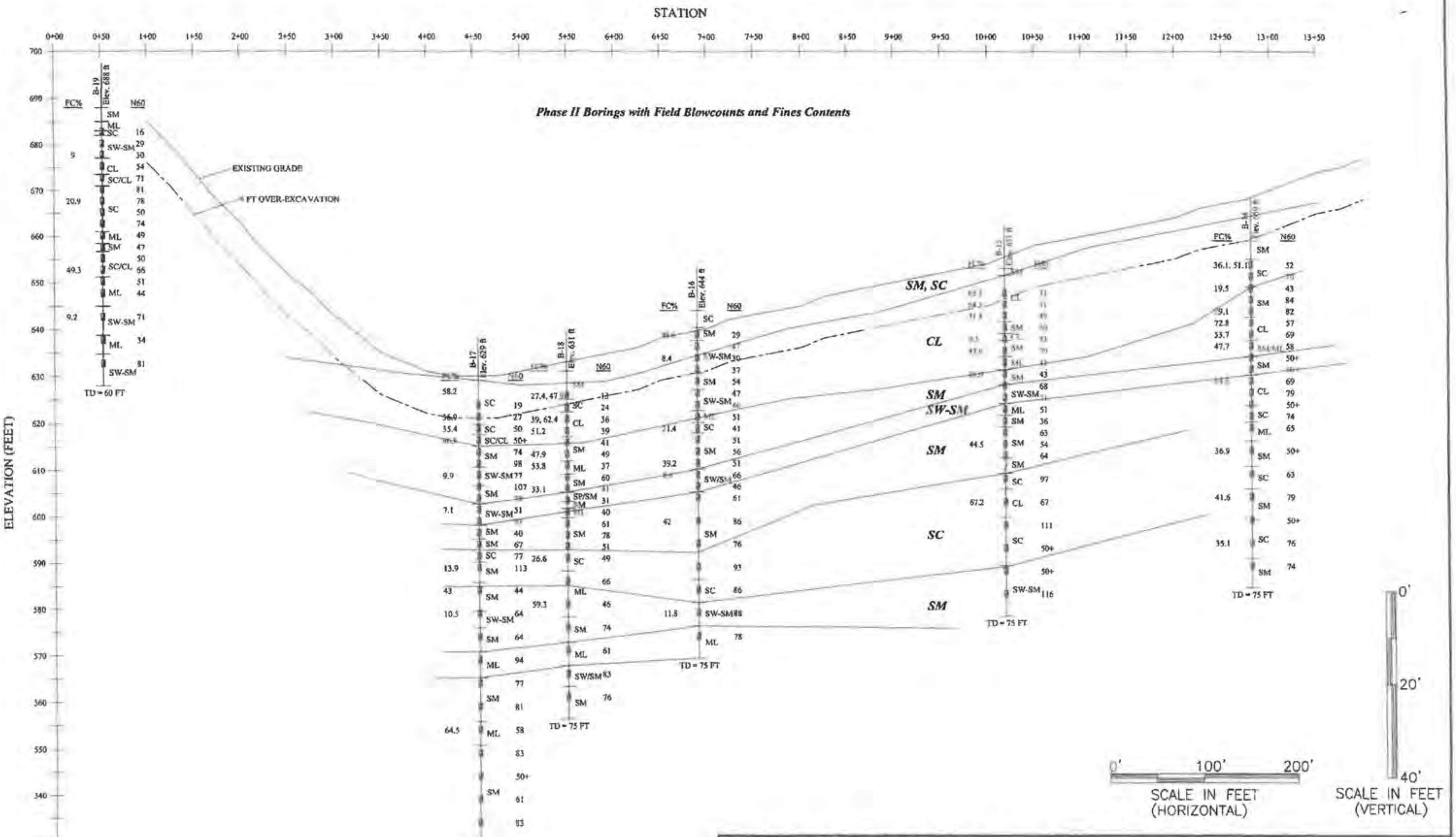

Note: Elevations based on NAVD88

SUBSURFACE PROFILE
GUZMAN RESERVOIR
EXHIBIT

KERN COUNTY, CA

Scale: AS SHOWN	Date: 2/24/17
Drawn by: MW	Approved by: DA
Project No. 022-15055	Figure No. 8

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Below the surface soils, 2 to 6 feet of loose to medium dense clayey sand or sandy clay was encountered. Field and laboratory tests suggest that these soils are moderately strong and only slightly compressible.

Below 4 to 8 feet interbedded layers of clayey sand, silty clay, silty sand with clay and sand were encountered. The interbedded layers ranged from 4 to 6 feet thick and extended to depths of 15 to 25 feet below the surface. These soil layers were medium dense to dense and relatively strong strength characteristics and are only slightly compressible.

Below 15 to 25 feet predominately sand or clayey sand was encountered and extended to the termination depth of our borings. These deeper soils had relatively strong strength characteristics and are only slightly compressible.

No groundwater was encountered within the soil borings. A subsurface profile of the soils encountered within the embankment footprint are shown in Figures 7 and 8. Figure 7 provides a soil profile obtained from the Phase I and Phase II soil borings. Exhibit 8 shows a soil profile from the Phase II borings which includes field blow counts and fines content. For additional information on soil encountered please refer the Log of Borings in Appendix A.

CONCLUSIONS AND RECOMMENDATIONS

General

The geologic and geotechnical conditions of the site are conducive to the development of the reservoir and associated embankment dam. The soil conditions below the loose surface soils appear to have relatively good strength characteristics. These soils should provide an adequate foundation for the proposed dam. The upper clayey sand and silty sandy soils with clay soils have a relatively low permeability and appears to be suitable for the use as dam embankment soil.

The upper 7 to 9 feet of soil has moderate blow counts and are moderately strong. However, these soils maybe prone to seismic settlement. To minimize seismic settlement, it is recommended that the upper 10 feet of soil within the embankment footprint and 10 feet beyond be excavated to a depth of 10 feet and backfilled with Class I Select Engineered Fill soil.

The upstream slope of dam embankment should be constructed to 3 horizontal to 1 vertical. The downward slope of embankment should be constructed to 3 horizontal to 1 vertical. The minimum width of the embankment crest should be 20 feet. The saddle dam should have an upstream slope of 3 horizontal to 1 vertical. The downward slope of the saddle embankment should be 2 horizontal to 1 vertical. The minimum width of the saddle dam embankment crest shall be 12 feet.

A two foot thick sand drain should be placed along the bottom of the primary dam. This sand drain should extend through the stability buttress.

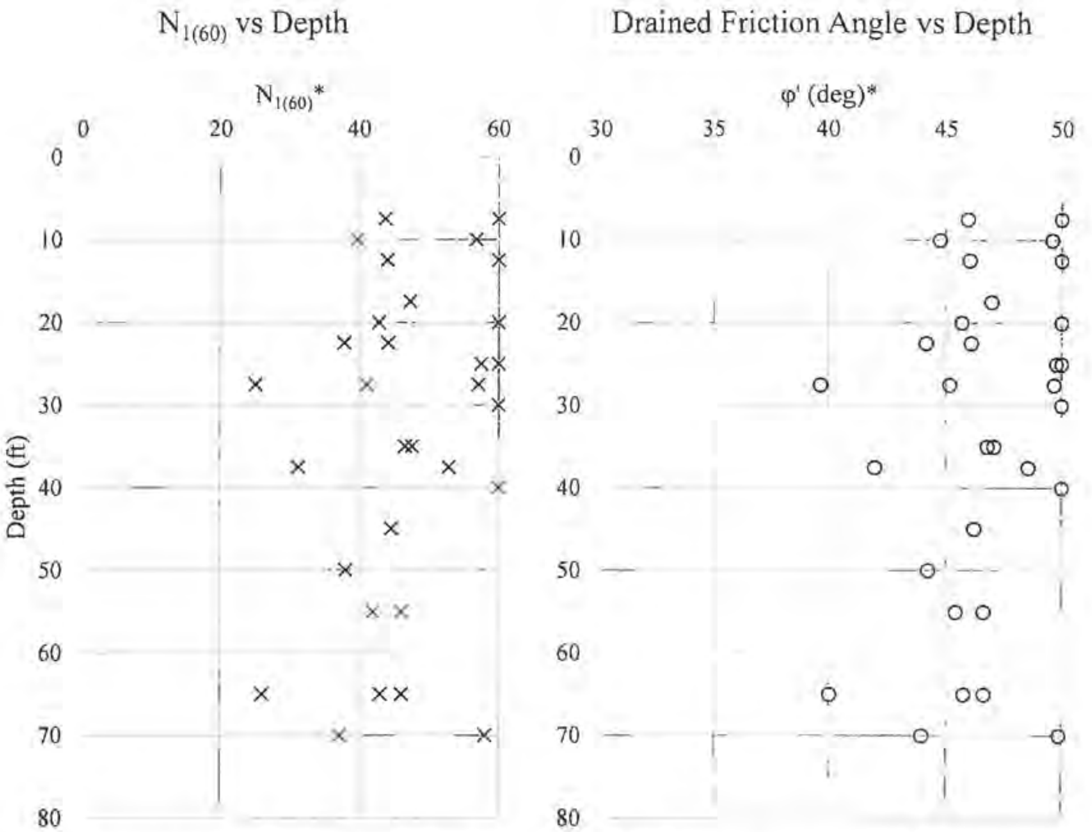
The reservoir site has a gently rolling terrain with a maximum slope of approximately 15 degrees. No major signs slope instability were observed.

Foundation Strength Properties

Cohesionless Materials Strength Properties:

Drained friction angles for cohesionless materials were determined using the Hatanaka, M. and Uchida, A. (1996) empirical method based on normalized blow counts ($N_{1(60)}$). An energy correction was applied to the field blow counts based on the hammer energy ratio of the drill rigs used during the exploration to obtain N_{60} values. Borehole and rod length correction factors were equal to 1. The corrected N_{60} values were then normalized and corrected for overburden by multiplying by C_N, where $C_N = \frac{\sqrt{P_a}}{\sigma' v_0}$, P_a is atmospheric pressure, and σ'_{v0} is the vertical effective stress.

For layers with fines less than 30%, the $N1_{(60)}$ blow counts and drained friction angles are plotted versus depth.



*N1(60) blowcounts and φ' were capped at 60 blows/foot and 50 degrees, respectively, for presentation purposes.

Fine-Grained Material Properties:

The strengths for the fine-grained soils and coarse-grained soils with greater than 30% fines were obtained through consolidated undrained triaxial tests (CU-TX). A combination of relatively undisturbed and bulk samples were obtained during the Phase II geotechnical exploration program. Additional bulk samples were obtained as a supplemental to the Phase II Geotechnical Exploration Program. The bulk samples of proposed embankment fill material were reconstituted to 95% relative density modified proctor at approximately 2% above optimum moisture content to represent compacted conditions within the embankment. The confining pressures selected for each triaxial test were based on the expected range of stresses the material would be subjected to immediately following construction and long-term.

Table 1 summarizes the results of the laboratory consolidated undrained triaxial tests.

Table 1: Consolidated Undrained Triaxial Test (CU-TX) Results

Undisturbed						
Location	**USCS**	**Depth (ft)**	**φ (deg)**	**c (psf)**	**φ' (deg)**	**c' (psf)**
B16 19-20'	SM	19	26.4	200	33.7	100
B18 11.5-13'	SC	11.5	21.6	600	27.9	750
B18 13-16'	SC	13	16.7	2000	22.5	1600
B16 25-28'	SC	25	20	1200	24.2	1100
Remolded*						
Location	**USCS**	**Depth (ft)**	**φ (deg)**	**c (psf)**	**φ' (deg)**	**c' (psf)**
TP21 3-3.5'	SC	3	14.1	280	31.9	150
TP28 2-2.5'	SC	2	13.8	320	31	200
TP31 4-4.5'	SM	4	26.6	1500	36.1	200
TP33 4-4.5'	SC	4	14.5	450	30.8	250
Remolded**						
Location	**USCS**	**Depth (ft)**	**φ (deg)**	**c (psf)**	**φ' (deg)**	**c' (psf)**
TP18A 2-4'	SC	2-4	13.0	600	22.7	600
TP18A 7-9'	SC	7-9	14.0	400	27.9	400
TP21A 2-4'	SC	2-4	16.7	600	30.2	400
TP21A 6-7'	SM	6-7	15.6	3500	28.8	1500
TP28A 2-4'	SC	2-4	17.5	600	30.0	250
TP28A 4-6'	SC/CL	4-6	15.5	300	26.0	300

**Bulk samples remolded to approximately 92-95% relative compaction of modified proctor at or above optimum moisture.*

***Bulk samples remolded to approximately 95% relative compaction of modified proctor at or above optimum moisture.*

Table 2 summarizes the selected strength parameters for the foundation and embankment materials.

Table 2: Selected Strength Properties

Foundation						
Material	**USCS**	**φ**	**c (psf)**	**φ'**	**c' (psf)**	**Source**
Clayey Sand (Upper)	SC	15.3	500	27.4	390	CU-TX (remolded)
Well Graded Sand with Silt	SW-SM	47.0	0	47.0	0	Hatanaka, M. and Uchida, A. (1996)
Clayey Sand (Lower)	SC	15.3	500	27.4	390	CU-TX (remolded)
Embankment						
Material	**USCS**	**φ**	**c (psf)**	**φ'**	**c' (psf)**	**Source**
Clayey Sand	SC	15.3	500	27.4	390	CU-TX (remolded)

The selected soil strength properties for the Class 1 embankment and foundation material is the average strength properties obtained from triaxial tests performed on blended soil samples collected during the supplemental Phase 2 field work (excluding the high strength results of the Silty Sand TP21A @ 6-7 feet).

Some silty sands and clayey sands within the dam footprint are weakly cemented. These soils have relatively strong strength characteristics. The cemented soil can be weakened by the introduction of acidic water. The primary water source for the reservoirs is a byproduct from the production of crude oil. This water will be obtained from the CRC North and Hathaway Oil Leases. Water quality tests for both leases have been performed. The results of the test indicate that water is not acidic with pHs of 7.4 and 7.75. Based on the pH of the proposed water sources, we do not believe that water will weaken the cemented soil.

The foundation soil below 10 feet is relatively strong. It is recommended that upper 10 feet of soil within the dam footprint be overexcavated and backfilled with Class I Selected Engineered Fill. The recompaction of the upper soils will create strong foundation for the dam. Saturation of the recompacted soils and native soils below 9 feet will not significantly affect their strength characteristics.

Stability Analysis of Dam

The stability of the proposed embankment was evaluated using the program Geostudio Slope/W. Spencer's method was selected for the analysis. Rotational and block failure surfaces were considered during the evaluation. Figure 9 displays the assigned materials.

Four loading conditions were considered during this stability analysis:

1. Post-construction (total stresses)
2. Steady-Seepage (effective stresses)
3. Pseudostatic (total stresses)
4. Sudden Drawdown (total stresses)

The full reservoir level (El. 673 ft) was used for the steady-seepage, pseudostatic and sudden drawdown scenarios. The phreatic surface for these cases is based upon the results of the steady-state seepage model using Geostudio Seep/W. No phreatic surface was applied to the post-construction scenario as the depth to groundwater exceeds 100 feet and is not expected to influence the construction of the embankment. The sudden drawdown scenario assumes an instantaneous full drawdown of the reservoir. The staged sudden drawdown method in Slope/W were applied during this scenario.

Model Parameters

🟦 Material 1
Embankment Fill (SC)
$\gamma_m = 120$ pcf, $\gamma_{sat} = 125$ pcf
$\varphi = 15.3°$, c = 500 psf
$\varphi' = 27.4°$, c' = 390 psf
$k_v = 4e\text{-}6$ cm/s, $k_h = 1.6e\text{-}5$ cm/s

🟨 Material 2
Silty Sand (SM)
$\gamma_m = 120$ pcf, $\gamma_{sat} = 125$ pcf
$\varphi = 26.4°$, c = 200 psf
$\varphi' = 33.7°$, c' = 100 psf
$k_v = 5e\text{-}4$ cm/s, $k_h = 2e\text{-}3$ cm/s

🟫 Material 3
Native Sandy Clay (SC)
$\gamma_m = 120$ pcf, $\gamma_{sat} = 125$ pcf
$\varphi = 0°$, c = 0 psf
$\varphi' = 0°$, c' = 0 psf
$k_v = 7e\text{-}6$ cm/s, $k_h = 2.8e\text{-}5$ cm/s

🟧 Material 4
Sand with Silt (SW-SM)
$\gamma_m = 120$ pcf, $\gamma_{sat} = 125$ pcf
$\varphi = 46°$, c = 0 psf
$\varphi' = 46°$, c' = 0 psf
$k_v = 4e\text{-}3$ cm/s, $k_h = 8e\text{-}3$ cm/s

🟥 Material 5
Clayey Sand (SC)
$\gamma_m = 120$ pcf, $\gamma_{sat} = 125$ pcf
$\varphi = 20°$, c = 1,200 psf
$\varphi' = 24.2°$, c' = 1,100 psf
$k_v = 7e\text{-}6$ cm/s, $k_h = 2.8e\text{-}5$ cm/s

⬛ Material 6
Sand (SP) - Drain
$\gamma_m = 120$ pcf, $\gamma_{sat} = 125$ pcf
$\varphi = 31°$, c = 100 psf
$\varphi' = 31°$, c' = 100 psf

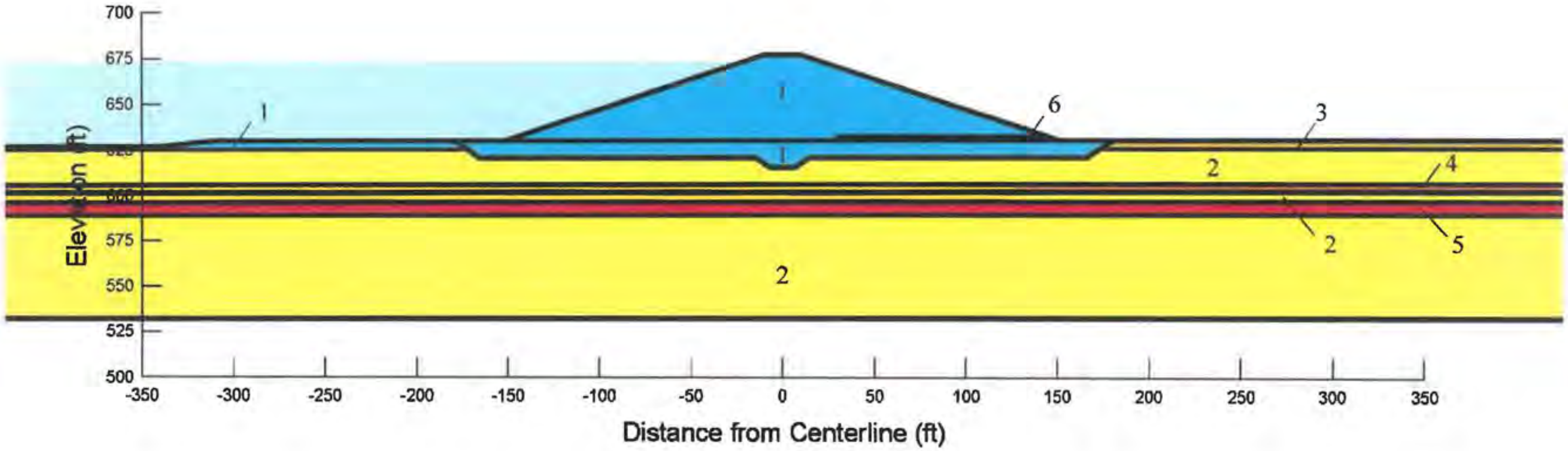


Figure No. 9

Post-Construction - Upstream

Total Stresses

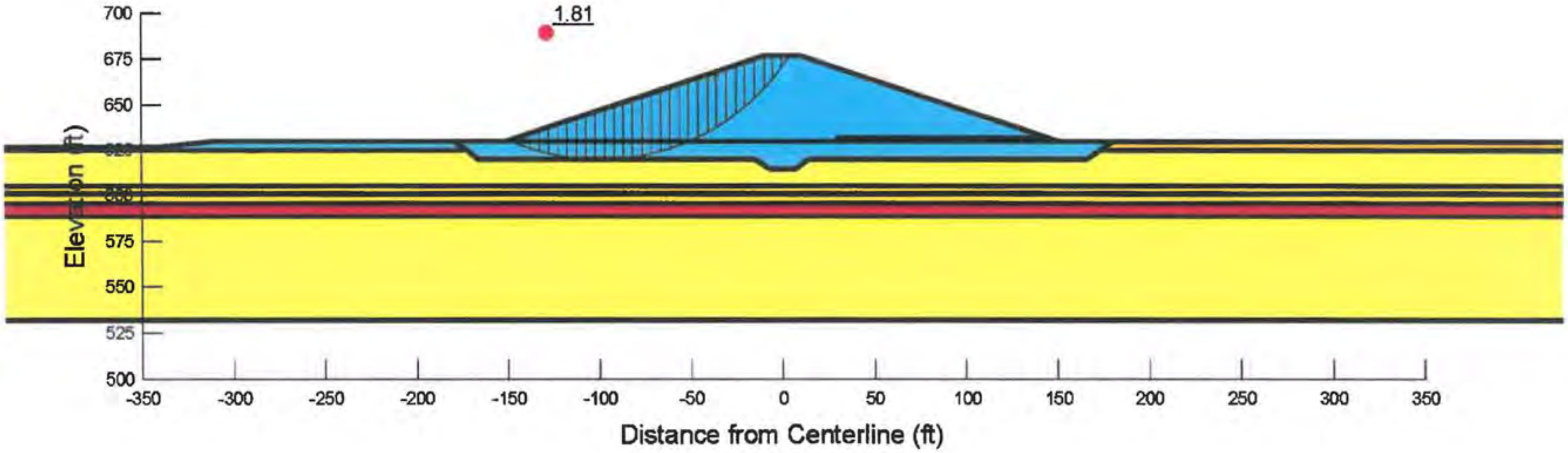


Figure No. 10

Post-Construction - Downstream

Total Stresses

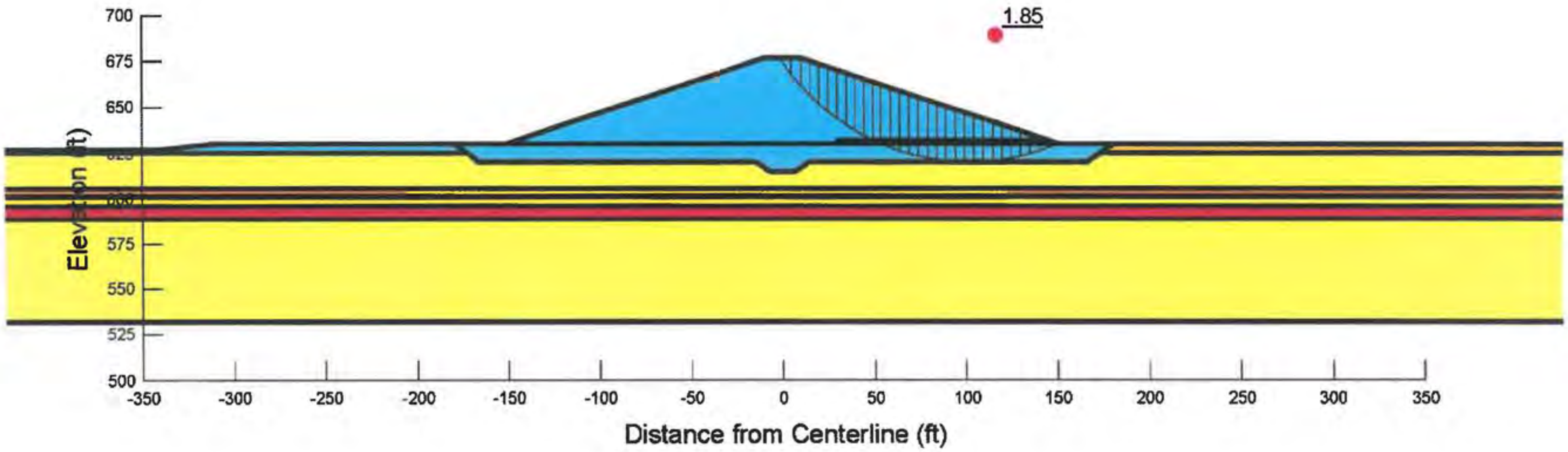


Figure No. 11

Steady State

Effective Stresses

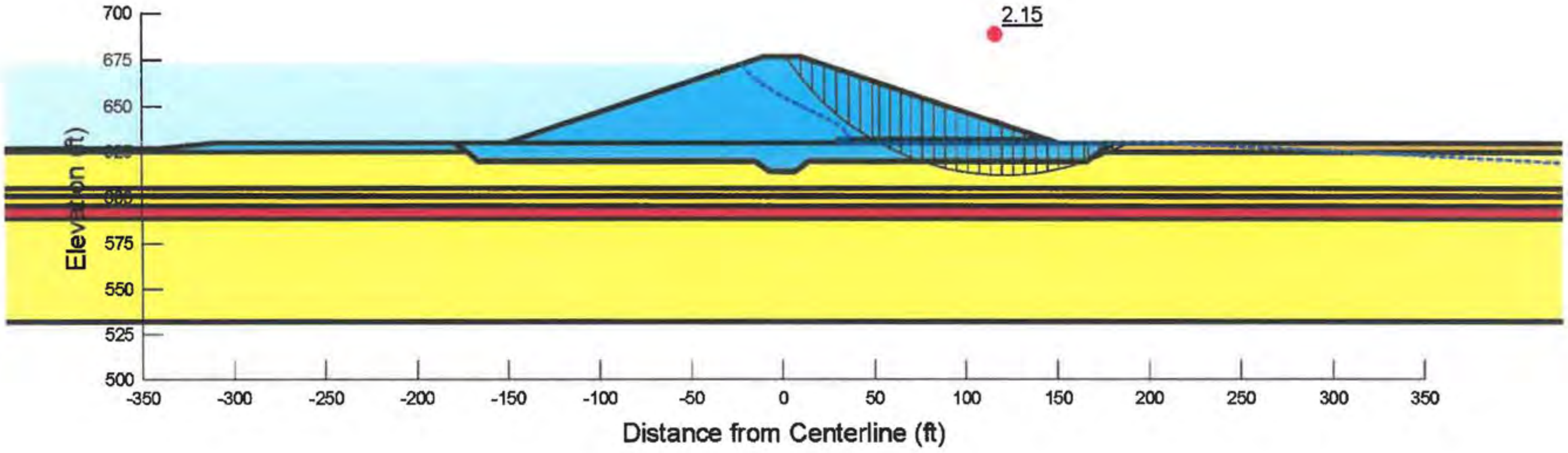


Figure No. 12

Pseudostatic - Upstream

Total Stresses

Seismic Coefficient = 0.15g

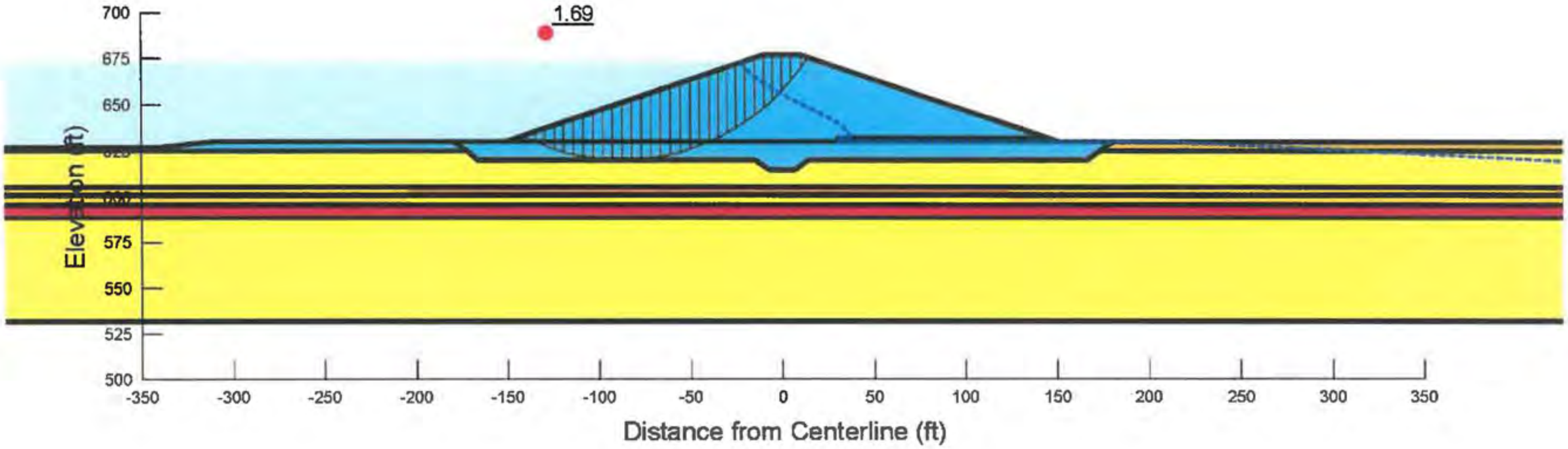


Figure No. 13

Pseudostatic - Downstream

Total Stresses
Seismic Coefficient = 0.15g

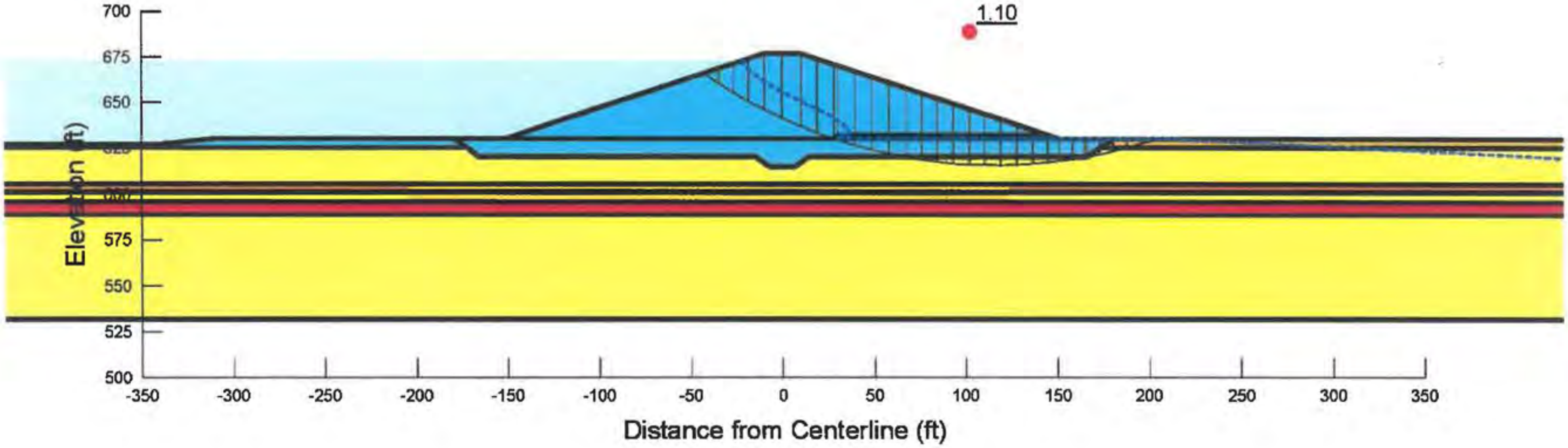


Figure No. 14

Sudden Drawdown

Total Stresses

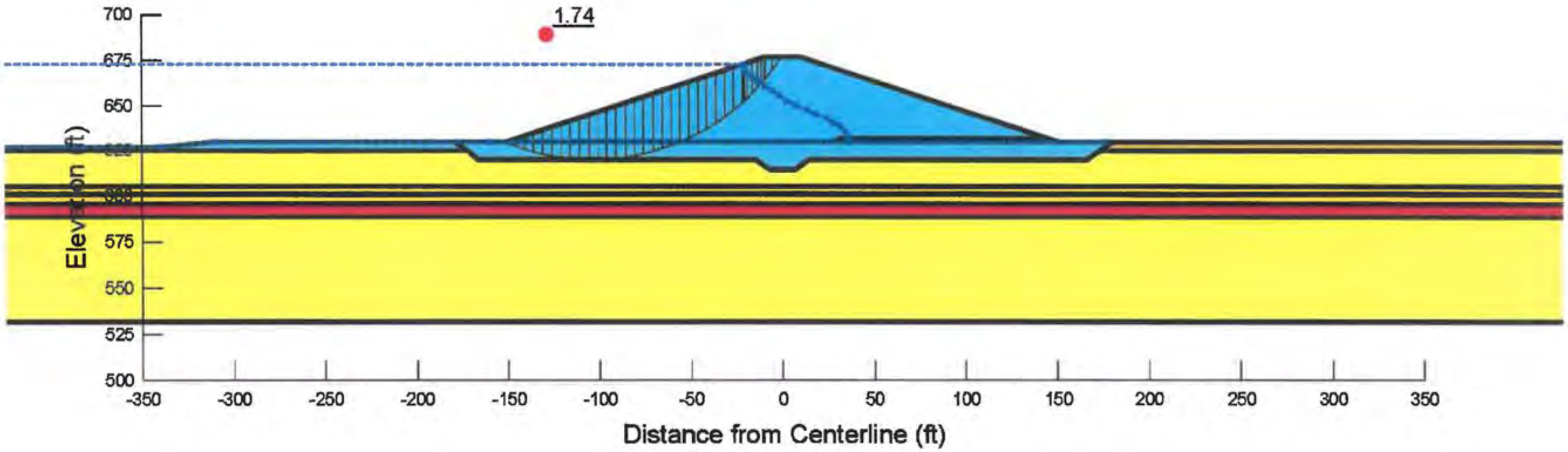


Figure No. 15

The governing, critical loading condition for the embankment was the pseudostatic case. A horizontal seismic coefficient of 0.15g was applied to the embankment under a full reservoir level. In order to meet the factor of safety requirements for pseudostatic loading on the downstream side, a stability buttress was placed on the toe to resist deeper rotational failures, and the downstream slope was adjusted to 2.5 horizontal to 1 vertical to address localized failures on the upper portion of the slope. The proposed stability buttress at the maximum height of the dam is 42 feet wide and extends 17 feet above the 2 foot thick sand drain with a 2.5 horizontal to 1 vertical downstream slope.

Table 3 summarizes the loading conditions, resulting factors of safety, and the required factors of safety.

Table 3: Factors of Safety

Loading Condition	Factor of Safety		Required
Post-Construction	1.81 (U/S)	1.85 (D/S)	1.25
Steady-Seepage	2.15		1.5
Pseudostatic	1.69 (U/S)	1.1 (D/S)	1.1
Sudden Drawdown	1.74		1.25

Figures 10 through 15 present the critical failure surfaces for the above loading conditions.

Seepage Evaluation of Dam

Seepage Design Criteria:

A steady state seepage evaluation was performed on the proposed embankment under a full reservoir level (El. 673 feet). A two foot thick sand drain at the downstream toe extends from 30 feet downstream of the embankment centerline to the downstream toe.

Seepage Material Properties:

The permeability properties for the embankment were selected based on laboratory falling head permeability tests. The soil samples were reconstituted to 95% of modified proctor to represent compacted embankment conditions. Table 4 summarizes the results of the remolded samples.

Table 4: Summary of Laboratory Permeability Tests Considered For Embankment Fill

Location	USCS	k_v (cm/s)
TP 17 0'	SC	8.4E-06
TP 21 3'	SC	5.8E-07
TP 26 0'	SC	2.9E-06
TP 3 2'	SC	5.9E-06
TP 30 0'	SC-CL	4.9E-06
TP 7 0'	SC	3.6E-06

Steady State Seepage

Free-field depth to groundwater ≥ 125 ft
Distance from upstream toe to borrow excavation ≥ 150 ft
Compacted clayey sand liner of borrow excavation ≥ 2 ft

$i_{exit} = 0.28$ (at downstream toe)

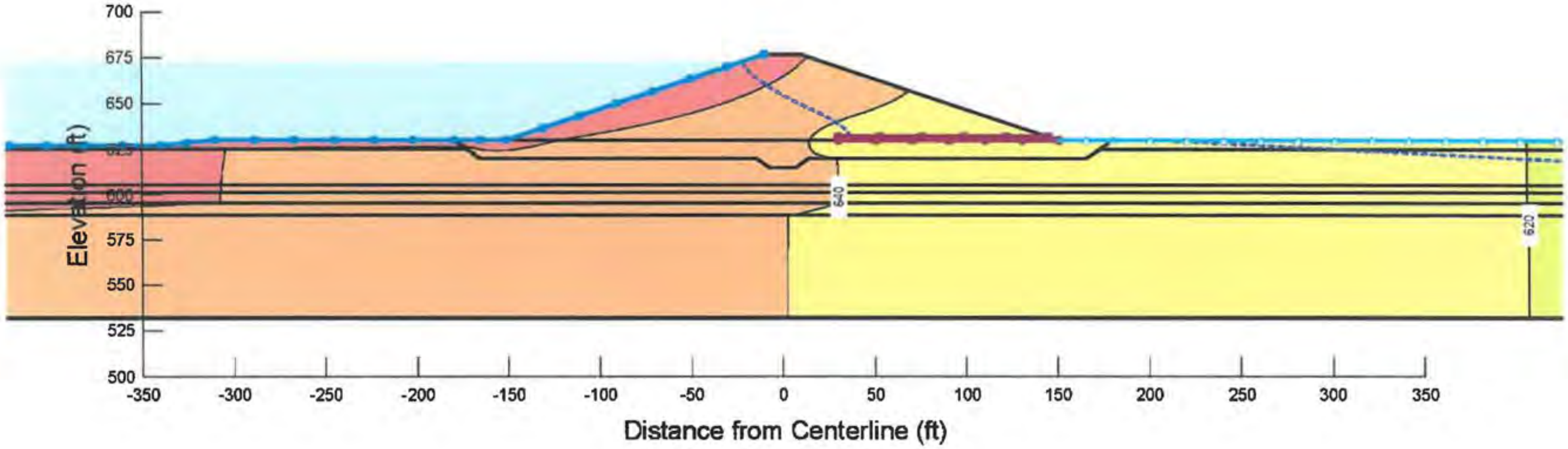


Figure No. 16

Seepage Model Overview

Free-field depth to groundwater ≥ 125 ft
Distance from upstream toe to borrow excavation ≥ 150 ft
Compacted clayey sand liner of borrow excavation ≥ 2 ft

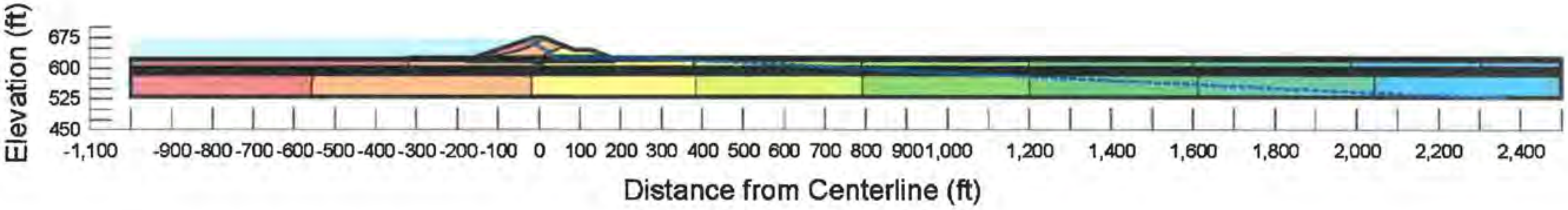


Figure No. 17

For the embankment material, a horizontal hydraulic conductivity (kv) of 4.0E-6 cm/s was selected as a representative value based on the laboratory data and typical values of a high fines clayey sand.

The hydraulic conductivities of the foundation soils were selected based on typical values considering fines contents. Table 5 summarizes the chosen properties.

Table 5: Selected Hydraulic Conductivities

Material	USCS	k_v (cm/s)	k_h (cm/s)
Clayey Sand (Embankment)	SC	4.0E-06	1.6E-05
Clayey Sand (Foundation)	SC	7.0E-06	2.8E-05
Silty Sand	SM	5.0E-04	2.0E-03
Well Graded Sand with Silt	SW-SM	4.0E-03	2.6E-04

Seepage Model

The steady state seepage of the embankment with a full reservoir was modeled using Geostudio Seep/W. Figure 9 presents the modeled embankment along with the assigned material properties, and Figures 16 and 17 shows an overview of the modeled embankment. The modeled blanket layer includes a 2-foot thick compacted clayey sand layer within the reservoir, a 5-foot thick layer of compacted clayey sand extending upstream of the embankment, the 10-foot thick over-excavated and recompacted subgrade for the reservoir, and a 5-foot thick layer of native material downstream of the embankment. Conservatively, this model does not include a clay to clayey sand layer that was present in Borings 17 and 18 at depths from approximately 9 to 14 feet below ground surface.

The following boundary conditions were applied to the seepage model:

1. Upstream face and reservoir bottom: Head of 673 feet
2. Downstream face and downstream ground surface: Potential Seepage Face
3. Sand Drain: Pressure Head of 0 feet
4. Downstream Extents: Head of 502 feet

In order to obtain an exit gradient at the downstream toe less than the required 0.5, three components of the design were evaluated. These include the distance from the upstream toe to the limits of the borrow excavation, the thickness of the compacted layer of clayey sand in the borrow area, and the free-field depth to groundwater. The sensitivity analyses showed that although the exit gradient is a function of the distance to the borrow excavation and the thickness of the reservoir compacted clayey sand layer, it is heavily dependent on the free-field depth to groundwater. In order for the model to have an acceptable exit gradient at the downstream toe, the groundwater must be at least 125 feet deep at a distance of 2,500 feet from the dam.

Groundwater was not encountered during the geotechnical explorations. To determine a reasonable free-field depth to groundwater, groundwater monitoring well data and regional Depth to Groundwater Maps were studied. In the general region of the proposed embankment site, the "Kern Groundwater Basin, Spring 2010, Lines of Equal Depth to Water in Wells, Unconfined Aquifer" map show depths ranging from 250 feet to 450 feet. Groundwater monitoring wells in closer proximity to the embankment were considered to obtain a more refined depth to groundwater. Table 6 summarizes recent groundwater readings at nearby monitoring wells.

Table 6: Recent Depth to Groundwater Readings Near the Embankment

Station	Latitude	Longitude	Approx. Distance (ft)	Reading Date	Depth to Groundwater (ft)
357364N1190640W001	35.7364	-119.064	200	3/9/2015	630
				10/13/2015	695
				3/2/2016	643
357450N1190676W001	35.7450	-119.0676	2700	10/13/2015	638
				3/9/2015	581
				1/29/2014	571
357281N1190706W001	35.7281	-119.0706	3300	3/2/2016	657
				1/29/2014	656

Since 1982, the depth to groundwater at Monitoring Well Station 357450N1190676W001 has not been less than 500 feet.

Based on this data, it can be assumed the phreatic surface downstream of the embankment will taper off significantly, and assigning a minimum depth to groundwater of 125 feet at a distance of 2,500 feet away is reasonable. It should be noted that the seepage and stability of the embankment should be monitored if any future developments nearby result in a raised groundwater elevation.

To a lesser extent, the distance of the borrow material excavation to the upstream toe and the thickness of the resulting compacted clayey sand layer also impact the exit gradient. The recommended seepage model specifies a minimum distance of 150 feet between the excavation area and the upstream toe, and a minimum thickness of compacted layer of clayey sand of 2 feet.

Dam Settlement Evaluation

A settlement analysis was performed at the maximum cross-section of the dam to estimate the elastic, primary and secondary settlements to be expected during and after construction of the embankment. Laboratory tests were performed on both undisturbed and reconstituted samples to provide representative data for the embankment and foundations. For this settlement evaluation, the embankment cross-section was simplified by assuming the upstream and downstream faces are both 3H:1V slopes.

Laboratory Testing

Table 7 summarizes the consolidation tests performed on undisturbed samples, along with the estimates of maximum past pressure (P_p) and overconsolidation ratio (OCR).

Table 7: Undisturbed samples – Maximum Past Pressure and OCR

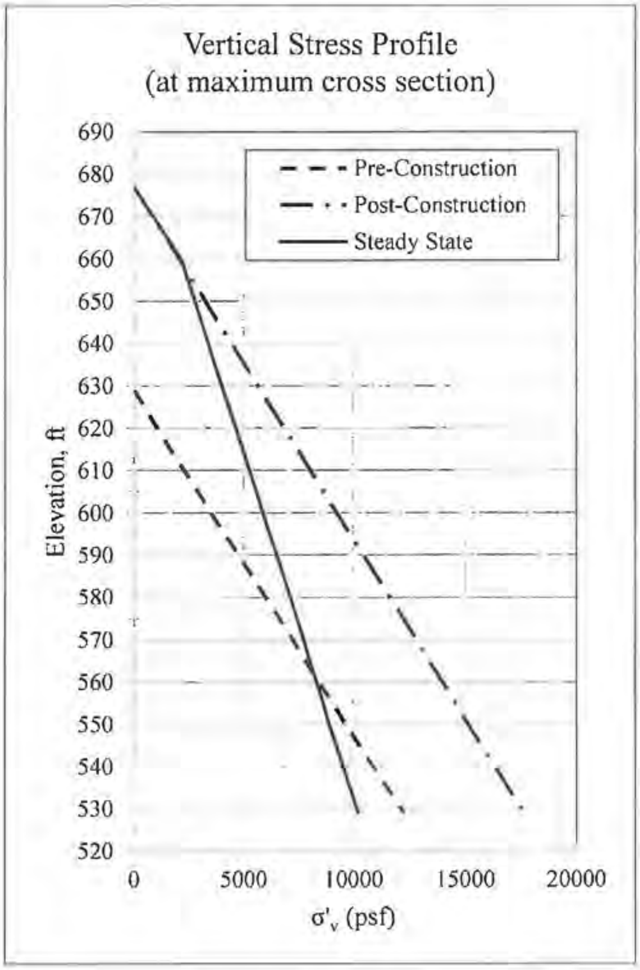
Sample	Elev. (ft)	σ'_{V0} (psf)	P_p (psf)	OCR
B18, 10'	621	1200	2100	1.8
B18, 13'	618	1520	3000	2.0
B16, 25'	619	3000	3000	1.0

Representative bulk samples for the embankment fill were remolded to 95% of modified proctor to obtain a representative sample of compacted fill. Table 8 shows the remolded samples for analysis of the embankment material.

Table 8: Remolded Samples - Maximum Past Pressure and OCR

Sample	$\sigma'_{V0} = P_p$ (psf)	OCR
TP21, 3'	2100	1.0
TP28, 2'	2100	1.0

The assumed vertical effective stress profiles for existing, post-construction, and steady-state conditions is shown below. The steady state condition corresponds to the steady state seepage condition with a full reservoir level.



The moist and saturated unit weights applied to the soil profile are summarized in Table 9.

Table 9: Assumed Unit Weights

Unit Weights		
USCS	**γ_m (pcf)**	**γ_{Sat} (pcf)**
CL	110	115
SC	120	125
ML	110	115
SM	120	125
SW-SM	120	125
Fill - SC	120	125

Primary Consolidation

For the primary consolidation determination, settlement was evaluated in a 4-foot thick upper clayey sand layer (El. 617 feet to 613 feet) and an 11.5 foot thick lower clayey sand layer (El. 595.5 feet to El. 581 feet).

The upper clayey sand layer is located on either side of the compacted keyed-in trench. The profile used in the analysis is represented by Boring 17, located at the maximum section of the dam.

The consolidation test data was processed by correcting the field consolidation curve on each test using Schmertmann's procedure, which yields the maximum past pressure, corrected compression index (C_c), corrected recompression index (C_r). Using the initial void ratios, the compression ratio (CR) and recompression ratio (RR) were determined for each test. Table 10 below summarizes the CR and RR values for the material tested.

Table 10: Summarizes the CR and RR Values for Materials Tested

Sample	**USCS (Location)**	**Initial void ratio, e_0**	**$CR= C_c/(1+e_0)$**	**$RR=C_r/(1+e_0)$**
B18, 10'	SC (Upper)	0.494	0.078	0.013
B18, 13'	SC (Upper)	0.539	0.073	0.015
B16, 25'	SC (Lower)	0.526	0.071	0.015
TP21, 3'	SC (remolded)	0.482	0.049	0.008
TP28, 2'	SC (remolded)	0.358	0.041	0.005

The increase in stress due to the construction of the embankment was estimated using the 2:1 stress distribution method for a strip footing. Using the change in pressure incurred at the respective depths, the settlement was then calculated at each compressible layer.

The utilized settlement equation:

$\Delta S = RR*H_o*\log(\sigma'_p/\sigma'_{vo}) + CR*H_o*\log((\sigma'_{vo} + \Delta\sigma_v)/ \sigma'_p)$, where H_o = initial height of the layer

The full equation is used for the upper clayey sand layer since the OCR is estimated to be approximately 2. The lower clayey sand layer is normally consolidated, so the equation simplifies to $\Delta S = CR*H_o*\log((\sigma'_{vo} + \Delta\sigma_v)/ \sigma'_p)$ since no recompression takes place.

The total amount of primary consolidation in the upper and lower clayey sand layers are estimated to be less than 5 inches.

Secondary Compression

Secondary compression was considered for the upper and lower clayey sand layers. The secondary compression was assumed to begin when at 90% of primary consolidation and continue for 50 years. The total estimated amount of secondary settlement over 50 years is 0.23 inches.

Immediate (Elastic) Settlement

The elastic settlement on the Engineered Fill within the dam and in the upper 9 feet of recompacted foundation soils were evaluated utilizing Navfac Design Manual 7.1. The elastic settlement was calculated utilizing the procedures outlined in Section 3 of Chapter 5 within the manual. The utilized elastic settlement equation is presented below.

$$\delta_v = q\,B(\frac{1-v^2}{E_\mu})$$

q = Overburden pressure
B = Base width of dam
ν = Poisson's ratio
$E\mu$ = Stress – strain modulus
I = Shape in rigidity factor

Based on the calculations, the total elastic settlement of 9 foot recompacted zone is approximately ¼ inch. The estimated total elastic settlement of the embankment dam soils is ¾ inch, therefore, the total estimated elastic settlement associated with the dam structure is approximately one inch.

The total primary settlement, secondary settlement, elastic settlement and seismic settlement is estimated at approximately 6 inches. The estimated differential settlement for the dam, structure, and foundation soils is estimated at 3 inches. Most of elastic settlement and primary settlement is expected to occur during construction as the loads are applied.

Potential Areas of Instability for Existing Slopes

The reservoir site area is gently rolling terrain with a maximum slope of approximately 15°. The underlying soils within these slopes have relatively good strength characteristics. No major signs of slope stability was observed. Slope stability evaluations indicate that these slopes are stable and are not prone to slope instability.

Design Criteria for Embankment Dam

Based on our evaluation, it appears that the site soils should provide adequate foundation support for the dam. Prior to dam construction, it is recommended that the upper 10 feet of soil be excavated within the embankment footprint and 10 feet beyond. The construction of the embankment dam and overexcavation foundation footprint should consist of Class I Select Engineered Fill as indicated in the Select Engineered Fill section. As specified, Class I fill should consist of silty sand soils with clay, clayey sand, and sandy clayey soils tht meet the specified grading requirements (see select Engineered Fill Section).

The upstream slope of dam embankment should be constructed to 3 horizontal to 1 vertical. The downstream slope of embankment should be constructed to 3 horizontal to 1 vertical. The minimum width of the embankment crest should be 20 feet.

The saddle dam should have an upstream slope of 3 horizontal to 1 vertical. The downward slope of the saddle embankment should be 2 horizontal to 1 vertical. The minimum width of the saddle dam embankment crest shall be 12 feet. The saddle dam shall the same recommendations for the overexcavation of the upper soils as specified for the primary dam.

The grading activities for the dam should include keying into the existing hillside slopes. Each key should extend into the existing hillside by at least 10 feet. The benching of the keys should be held to a maximum height of 4 feet.

Reservoir Liner

To minimize water seepage within the reservoir, it is recommended that the reservoir be lined with a 2 foot layer of clayey sand or sandy clay. The reservoir liner material should have at least 30 percent of fine grain soil passing the number 200 sieve. The layers should be compacted to a minimum of 100% of maximum of density based on ASTM Test Method D698 (standard proctor). The compacted liner should be moisture conditioned to at or above optimum moisture.

Sand Drain

It is recommended that a sand drain be associated with the dam. The sand layer should have a minimum thickness of 2 feet and shall be constructed at the base of the dam. The sand drain should be constructed within the downstream embankment and extend through the stability buttress. The sand drain shall meet ASTM D448, Blend 579 with the following gradation requirements:

Sieve Size	Percentage Passing
1½	100
1	90-100
¾	75-85
3/8	45-60
#4	20-35
#8	5-15
#16	0-5

The sand drain shall be enveloped by 1 foot thick layer of ASTM C33 sand meeting the grading requirements below.

Sand Layer Envelope

Sieve Size	Percentage Passing
3/8	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

Select Engineered Fill

The upper onsite soils are predominantly silty sands with clay, clayey sands, and sandy clays. The upper 1 to 1.5 feet of soil within the reservoir area had minor concentrations of organics. The soils below 1.5 feet will be suitable for use as Class I embankment soils within the proposed dam provided that these soils meet the gradation requirements listed on page 25. The Class I embankment soils should be visually inspected to confirm that they are free of organics. Sands were encountered at deeper elevations within the site and these soils will not be suitable for use as embankment fill. After stripping the organic topsoil, the upper 1.5 feet of soil which has at least 30 percent of fine grained soil passing number 200 sieve will be suitable for reuse as lining material within the reservoir.

Class I Gradation Requirements

Sieve Size	Percentage Passing
4	90-100
8	90-100
16	80-95
30	70-90
50	55-80
100	40-70
200	30-50

Class I embankment soils should have a Plasticity Index less than 25 and a plasticity limit between 7 to 25.

Fill soils should be placed in lifts of approximately six inches, moisture conditioned above optimum moisture and compacted to achieve at least 100% of maximum dry density as determined by ASTM Test Method D698 (standard proctor). Additional lifts should not be placed if previous lifts did not meet the required compaction or if the soil conditions are not stable.

LIMITATIONS

Soils Engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences advance. Although your site was analyzed using the most appropriate and most current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to advancements in the field of Soils Engineering, physical changes in the site, either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the soils report is completed may require the soils report to be professionally reviewed. In light of this, the Owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that 2 years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Soils Engineer should be notified so that supplemental recommendations may be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Soils Engineer should be notified of any changes so the recommendations may be reviewed and re-evaluated.

This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

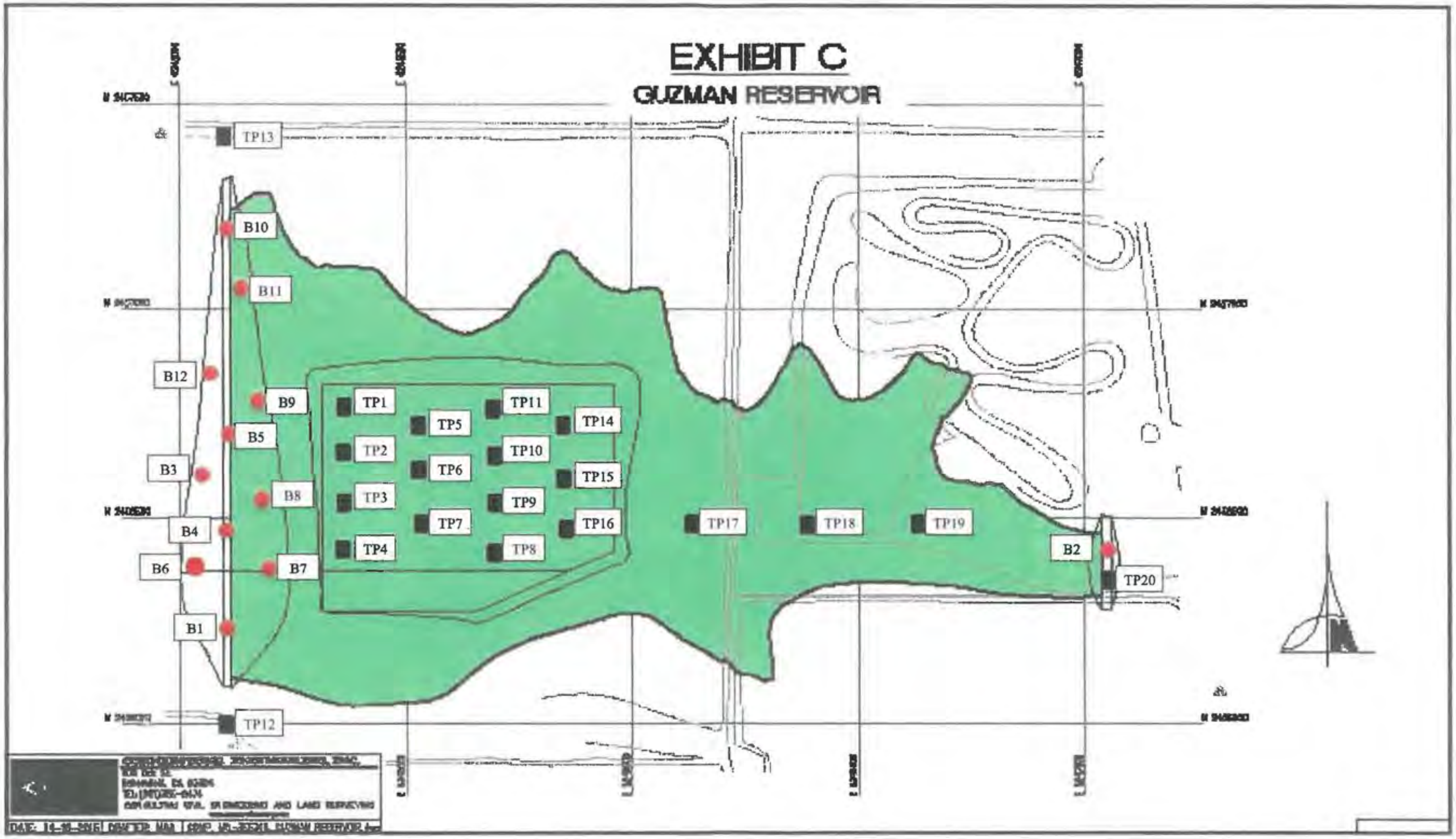
If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 348-2200.

DEAN ALEXANDER
NO. 2051
EXP. 9/30/2019

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Dean Alexander
Principal Engineer
RCE No. 34274/RGE No. 2051

DA/ljk

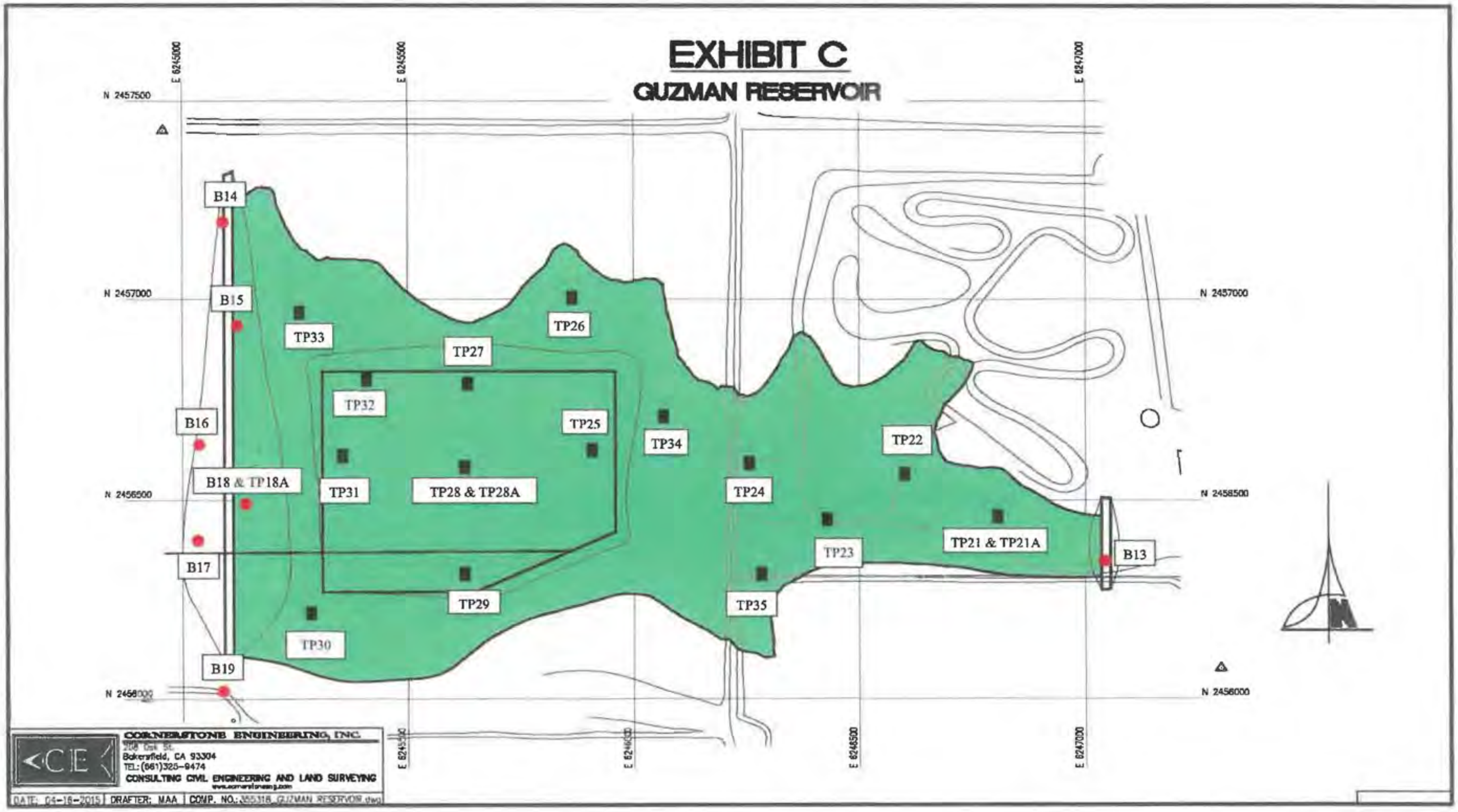


■ APPROXIMATE TEST PIT LOCATION

● APPROXIMATE BORING LOCATION

PHASE I

SITE MAP	Scale: NTS	Date: August 2015	**Krazan** **GEOTECHNICAL ENGINEERING**
GUZMAN RESERVOIR **EXHIBIT C** **KERN COUNTY, California**	Drawn by: HT	Approved by: DA	
	Project No. 022-15055	Figure No. 2	



■ TEST PIT LOCATION

● SOIL BORING LOCATION

PHASE II

SITE MAP	**Scale:** NTS	**Date:** November 2017	Krazan **GEOTECHNICAL ENGINEERING**
GUZMAN RESERVOIR **EXHIBIT C** **KERN COUNTY, California**	**Drawn by:** HT **Project No.** 022-15055	**Approved by:** DA **Figure No.** 2	

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Nineteen exploratory borings and 38 test pits were advanced. After completion, the soil exploration work, the soil boring holes were backfilled with grout. The boring and test pit locations are shown on the attached site plan.

The soils encountered were logged in the field during the exploration and with supplementary laboratory test data are described in accordance with the Unified Soil Classification System.

Within soil borings one through 12 performed in July of 2015 modified penetration test utilizing a California sampler were performed at depths of 2 feet, 4.5 feet, 10 feet, 15 feet, and 20 feet. The modified California sampler has a 2.5 inch inside diameter core barrel. Relatively undisturbed soil samples were obtained within the California sampler at the above specified depths. Below 15 feet within borings one through 12 standard penetration tests were performed at 5 foot intervals. The standard penetration test has a 1.5 inch diameter core barrel. Within borings 14 through 19 performed in June 2016 during our secondary soil exploration program, standard penetration tests (SPT) were performed at intervals of 2.5 feet starting a depth of 5 feet. The 2.5 feet SPT sampling intervals continued to a depth of 40 feet. Beyond 40 feet SPT samples were obtained at 5 foot intervals to the termination depth of the borings. Within boring No. 13 located at the channel section of the saddle dam SPT sampling was performed at intervals of 5 feet to the termination depth of the boring. Standard penetration tests were performed in accordance with ASTM Test Method D6066. Soil samples from the standard penetration test were collected at each location. Adjacent to borings 16 and 18 relatively undisturbed soil samples were collected utilizing a thin wall Shelby tube. The Shelby tube has a 3 inch diameter and is 36 inches long. The soil samples were collected utilizing a pitcher barrel sampler. The Shelby tube samples were collected at 3 foot intervals between 10 and 40 feet. Shelby tube samples were also collected at boring No. 13 located within the saddle dam footprint at 5 foot intervals starting at a depth of 7 feet to a depth of 32 feet.

The subsurface soil conditions were explored by utilizing CME 55 and 45C drill rigs. Hollow stem and straight flight auger were used for the soil exploration. Hollow stem auger was used for soil boring Nos. 13 through 19. Straight flight auger was used for boring Nos. 1 through 12 in addition to supplemental borings B13, B16 and B18 to collect the thin wall Shelby tube sampler. Standard penetration tests and

California split barrel samples were obtained utilizing an automatic driving hammer weighing 140 pounds and falling 30 inches. The CME auto hammers for both drill rigs were calibrated on June 1, 2015 and July 11, 2016. The calibrations are provided at the end of this Appendix.

Bulk soil samples were obtained at the test pit locations. Each sample was approximately 30 pounds. Samples were obtained from each soil type and within several test pits, soil samples were obtained at ½ foot intervals.

Soil sample location along with sampler type is shown within Log of Borings and Test Pits. The legend showing the sampling symbols is provided on the soil classification sheet immediately before the Log of Borings.

The collected Shelby tube samples were preserved by providing a wax seal on both ends of sample. The samples were handling in accordance with Group C of ASTM Test Method D4220. The Shelby tube soil samples were wrapped with plastic bubble wrap and placed within a confined storage box for transportation. Each day the samples were transferred to our climate controlled office for storage. The samples were kept sealed until specific laboratory testing was performed.

Laboratory Investigation

The laboratory investigation was programmed to determine the physical and mechanical properties of the foundation soil underlying the site. Test results were used as criteria for determining the engineering suitability of the surface and subsurface materials encountered.

The laboratory testing program was split into two segments – soil borings within the embankment footprint and test pits within the reservoir area.

Embankment Footprint:

Soil sampling within the embankment footprint consisted of compaction testing, in-place moisture content and densities (ASTM Test Method D2937), Maximum Density Determinations (ASTM Test Method D1557), Grain Size Analysis (ASTM Test Method C136), Particle Size Analysis by Hydrometer (ASTM Test Method D422), Atterberg Limit Test (ASTM Test Method D4318), Permeability Test (ASTM Test Method D5084), Triaxial Strength Testing (ASTM Test Method D4767) and Consolidation Tests (ASTM Test Method D2435).

Within the embankment footprint a total of 71 grain size analysis, 21 particle size analysis by hydrometer, 23 Atterberg limits, 3 consolidation tests, 6 Triaxial tests, 21 in-place moisture density, 5 permeability tests, and 5 moisture density relationship tests were performed.

Reservoir Area:

The reservoir area was evaluated for the suitability and field soils placed within the embankment area as well as a liner within the embankment area to reduce water infiltration. Laboratory testing within the reservoir area consisted of a series of Atterberg limits tests (ASTM Test Method D4318), Identification of Dispersive Clays by Pinhole Test (ASTM Test Method D4649), Grain Size Analysis (ASTM Test Method C136), Particle Size Analysis by Hydrometer (ASTM Test Method D422), Direct Shear Test (ASTM Test Method D3080), and Triaxial Strength Test (ASTM Test Method D4767).

Within the reservoir area a total of 53 grain size analysis, 14 particle size analysis by Hydrometer, 18 Atterberg limits, 2 consolidation tests, 10 Triaxial tests, 11 identified of dispersive clays by pin hole tests, 5 permeability tests, 20 moisture density relationship tests, and 3 direct shear tests were performed. A summary of the laboratory testing is shown in Appendix A, Table 1. The results of the laboratory testing are provided in Appendix B.

The logs of the exploratory borings are presented in this Appendix A.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART			
COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
	Clean Gravels (Less than 5% fines)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	⁘	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	⁘	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)		
	▦	GM	Silty gravels, gravel-sand-silt mixtures
	▩	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)		
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	⁙	SW	Well-graded sands, gravelly sands, little or no fines
	⁚	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)		
	▥	SM	Silty sands, sand-silt mixtures
	▨	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%	▥	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	▨	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	☰	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	▥	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	▨	CH	Inorganic clays of high plasticity, fat clays
	≋	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	⁂	PT	Peat and other highly organic soils

CONSISTENCY CLASSIFICATION	
Description	**Blows per Foot**
Granular Soils	
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 51
Cohesive Soils	
Very Soft	0 - 2
Soft	3 – 4
Firm	5 – 8
Stiff	9 – 16
Very Stiff	16 – 32
Hard	> 32

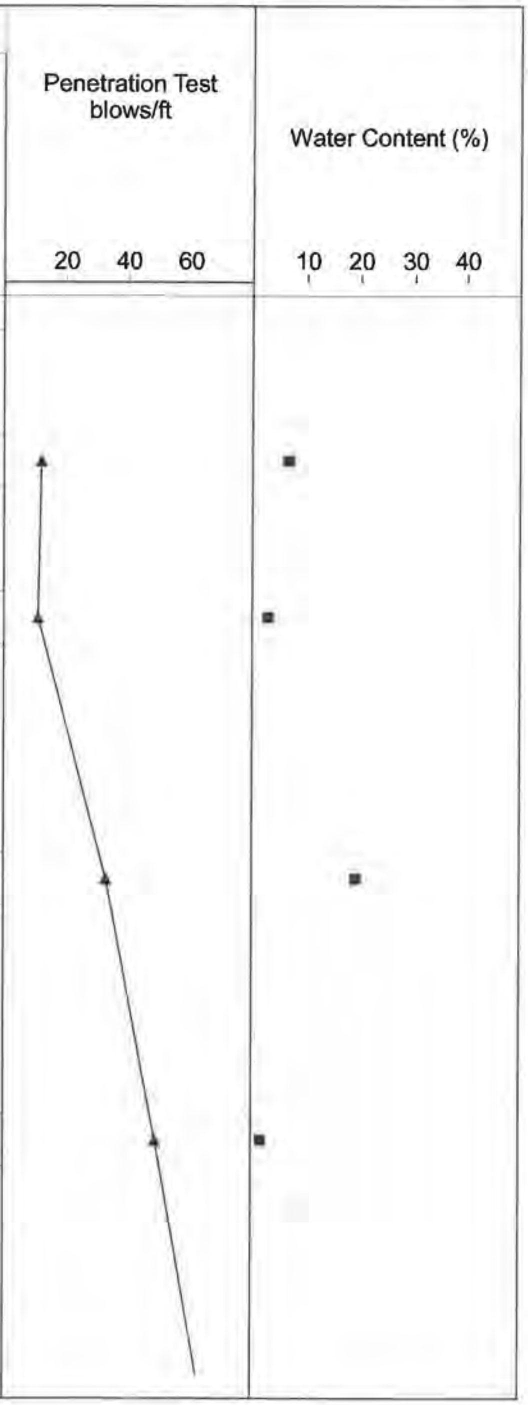
GRAIN SIZE CLASSIFICATION		
Grain Type	*Standard Sieve Size*	*Grain Size in Millimeters*
Boulders	Above 12 inches	Above 305
Cobbles	12 to 13 inches	305 to 76.2
Gravel	3 inches to No. 4	76.2 to 4.76
Coarse-grained	3 to ¾ inches	76.2 to 19.1
Fine-grained	¾ inches to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
Coarse-grained	No. 4 to No. 10	4.76 to 2.00
Medium-grained	No. 10 to No. 40	2.00 to 0.042
Fine-grained	No. 40 to No. 200	0.042 to 0.074
Silt and Clay	Below No. 200	Below 0.074

SAMPLE METHOD	
◩	Standard Penetration Sampler (Terzaghi) - 2 in O.D. (1 3/8 in I.D.) split spoon sampler (ASTM D1586-84)
▚	Thin Wall Shelby Tube Sampler 3 in O.D.
■	Modified California Sampler - 3 in O.D. (2 1/2in I.D.) sampler with metal sleeves
▥	Bulk Soil Sample

Log of Boring B1

Project: Guzman Reservoir
Project No: 022-15055
Client: Kern Tulare Water District
Figure No.: A-1
Location: Guzman, Kern County, CA
Logged By: Dave Adams
Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Loose, fine- to medium-grained; dark brown, damp, drills easily	95	6.7	■	12
4		***SAND (SP)*** Loose, fine- to coarse-grained; light brown, damp, drills easily				
			119	3.0	■	11
6						
8						
		SILTY SAND/SANDY SILT (SM/ML) Medium dense, fine- to medium-grained; brown, damp, drills easily				
10						
			117	19.3	■	33
12						
		SAND (SP) Dense, fine- to coarse-grained; light brown, damp, drills easily				
14						
			128	1.8	■	49
16						
18						
20					■	



Drill Method: Solid Flight
Drill Date: 7-9-15
Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 4½ Inches
Driller: Jim Watts
Elevation: 658 Feet
Sheet: 1 of 2

Log of Boring B1

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-1
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	20 40 60	10 20 30 40
	▨	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Dense to hard, fine- to coarse-grained reddish-brown, moist, drills easily	120	19.4	■	64	▲	■
22	▨							
24	▨							
		End of Borehole						
26								
28								
30								
32								
34								
36								
38								
40								

Drill Method: Solid Flight
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

Drill Date: 7-9-15
Hole Size: 4½ Inches
Elevation: 658 Feet
Sheet: 2 of 2

Log of Boring B2

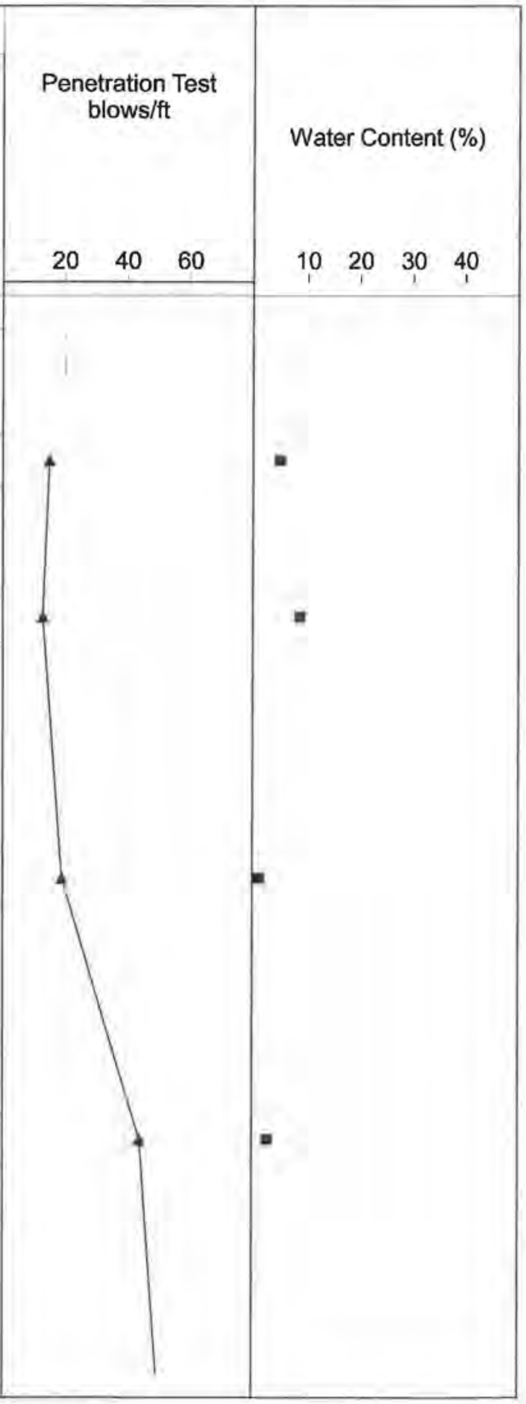
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-2

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE		SAMPLE			
Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	Ground Surface				
0	***CLAYEY SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, drills easily				
2	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Stiff, fine- to medium-grained; brown, damp, drills easily		5.0	■	15
		98	8.7	■	13
8	***SAND (SP)*** Medium dense, fine- to coarse-grained with trace CLAY; light brown, damp, drills easily				
		110	1.3	■	19
14	***SILTY SAND (SM)*** Dense, fine- to coarse-grained; brown, damp, with CLAY, drills easily				
		87	2.8	◢	44
20	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Hard, fine- to medium-grained; reddish-brown, damp, drills tightly			◢	



Drill Method: Solid Flight
Drill Date: 7-9-15

Drill Rig: CME 45C-3
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 657 Feet

Log of Boring B2

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

Project No: 022-15055

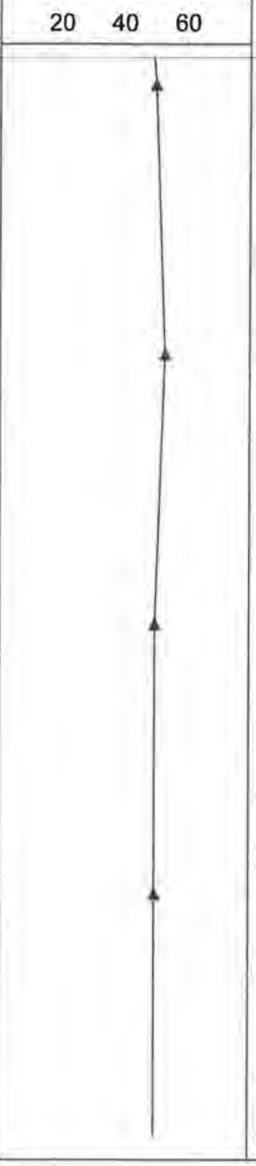
Figure No.: A-2

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
			122	7.8	◢	50+
22						
24		***CLAYEY SAND (SC)*** Very dense, fine- to medium-grained; light brown, damp, drills firmly				
			93	4.2	◢	53
26		Drills very hard below 26 feet				
28						
30						
			105	6.2	◢	50+
32						
34		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; brown, damp, with CLAY, drills hard				
				5.3	◢	50+
36						
38						
40					◢	

Penetration Test blows/ft



Water Content (%)

Drill Method: Solid Flight

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-9-15

Hole Size: 4½ Inches

Elevation: 657 Feet

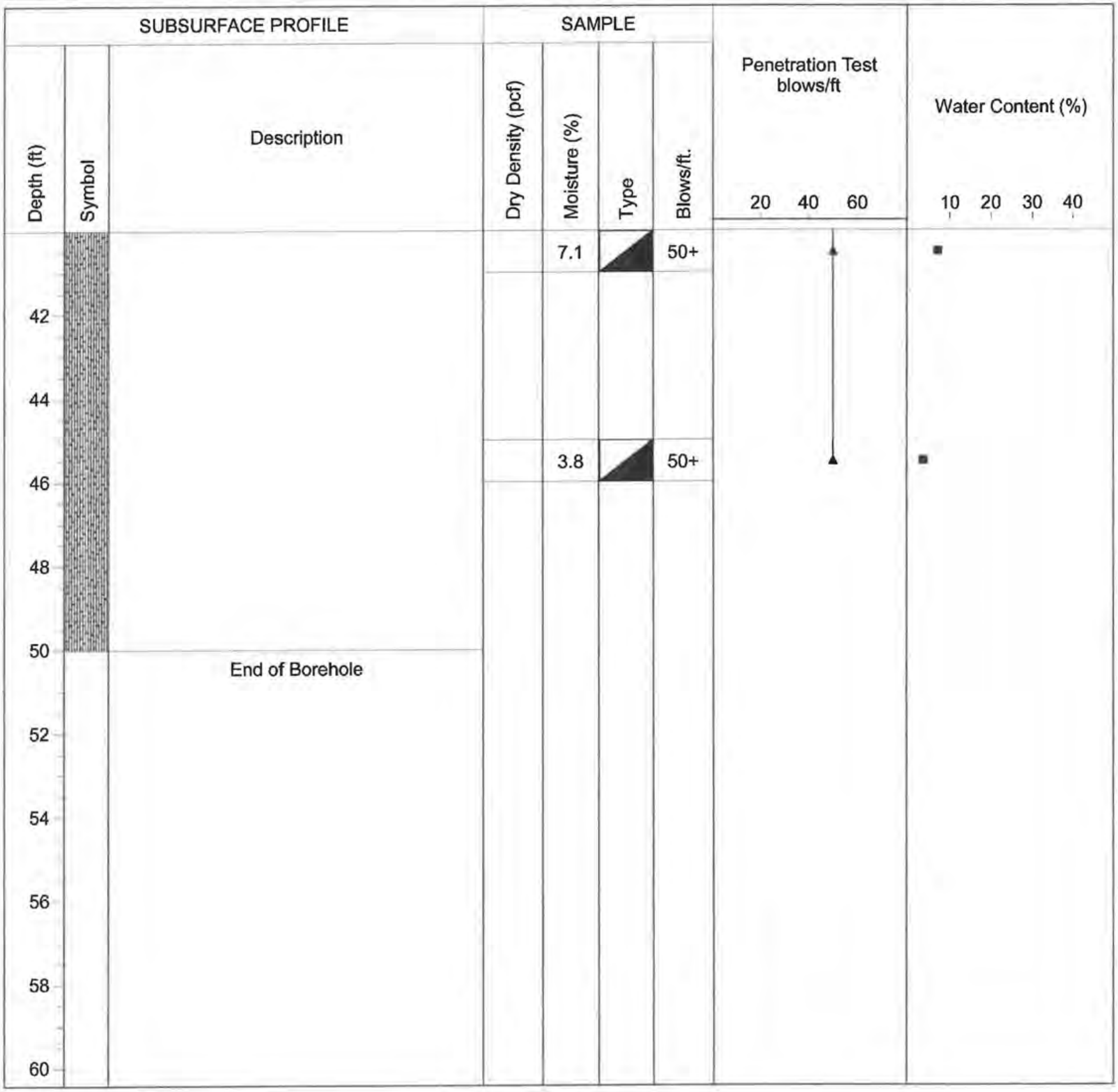
Sheet: 2 of 3

Log of Boring B2

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-2
Logged By: Dave Adams
At Completion: None



Drill Method: Solid Flight
Drill Rig: CME 45C-3
Driller: Jim Watts

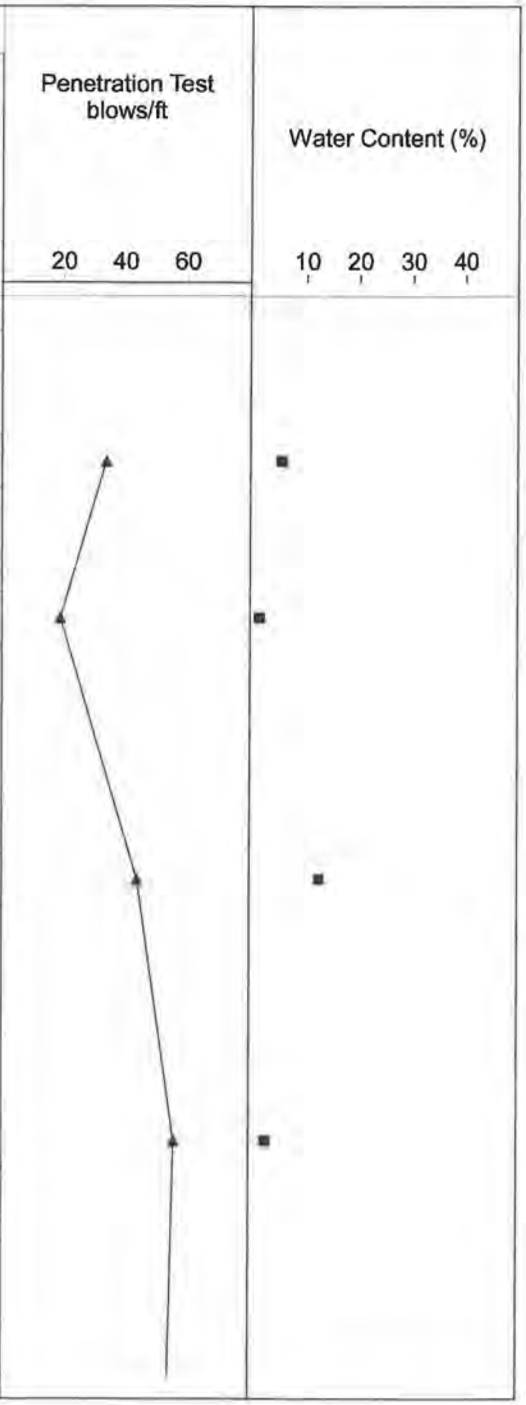
Krazan and Associates

Drill Date: 7-9-15
Hole Size: 4½ Inches
Elevation: 657 Feet
Sheet: 3 of 3

Log of Boring B3

Project: Guzman Reservoir
Project No: 022-15055
Client: Kern Tulare Water District
Figure No.: A-3
Location: Guzman, Kern County, CA
Logged By: Dave Adams
Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE		SAMPLE			
Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	Ground Surface				
0	***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2	Medium dense below 2 feet	98	5.7	■	34
4	***SAND (SP)*** Medium dense, fine- to coarse-grained with trace CLAY; light brown, damp, drills easily				
6		120	1.7	■	19
8	***CLAYEY SAND (SC)*** Dense, fine- to coarse-grained; brown, damp, drills easily				
10		126	12.7	■	44
12					
14	***SAND (SP)*** Dense, fine- to coarse-grained; light brown, damp, drills easily				
16		126	3.0	■	56
18	***SAND (SP)*** Dense, fine- to coarse-grained; light brown, damp, with SILT, drills easily				
20				■	



Drill Method: Solid Flight
Drill Date: 7-2-15
Drill Rig:
Krazan and Associates
Hole Size: 4½ Inches
Driller: Jim Watts
Elevation: 639 Feet
Sheet: 1 of 2

Log of Boring B3

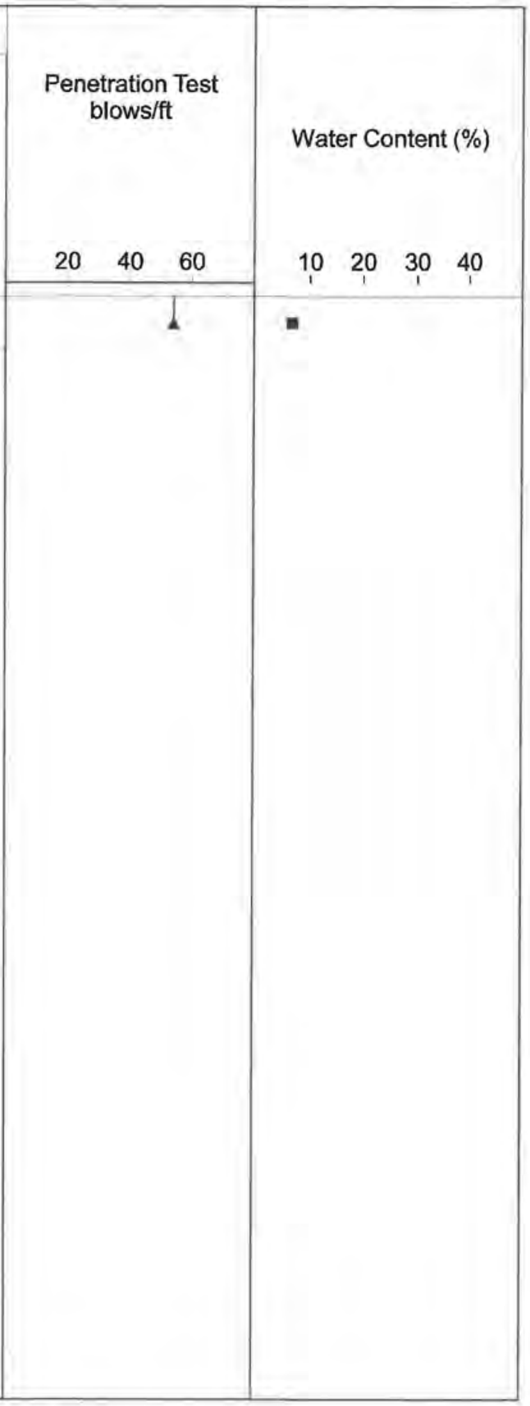
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-3

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		117	6.8	■	54
22	▨					
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight
Drill Date: 7-2-15

Drill Rig:
Hole Size: 4½ Inches

Krazan and Associates

Driller: Jim Watts
Elevation: 639 Feet

Sheet: 2 of 2

Log of Boring B4

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

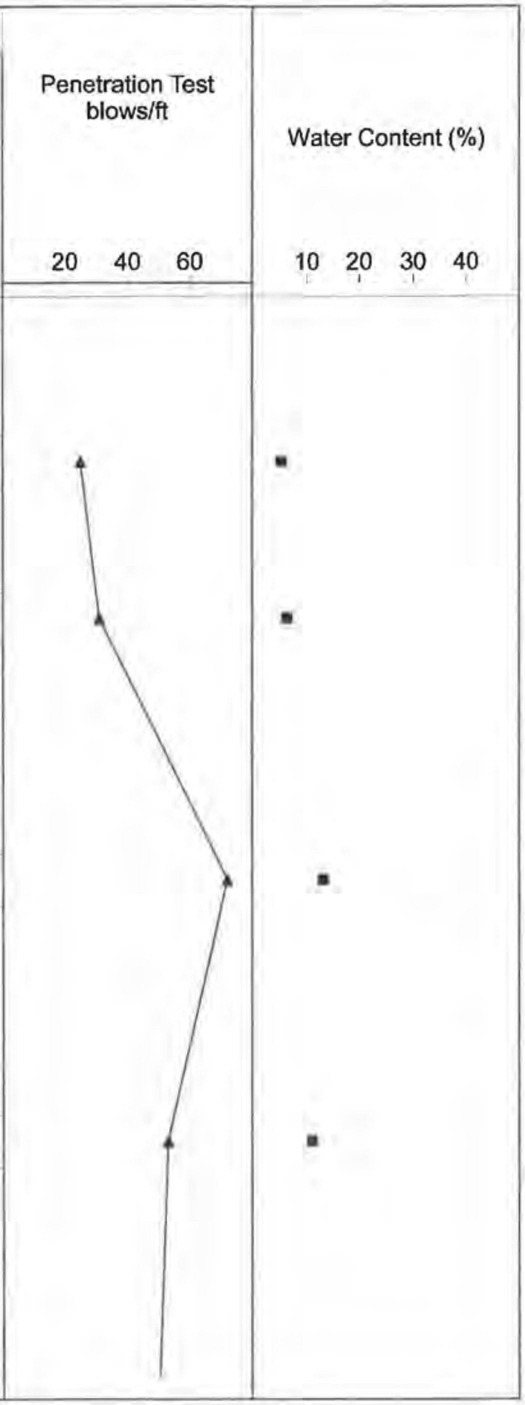
Project No: 022-15055

Figure No.: A-4

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2		Medium dense and dark brown below 2 feet	98	5.3	■	25
4		***CLAYEY SAND (SC)*** Medium dense, fine- to medium-grained; brown, damp, drills easily	98	6.4	■	31
6						
8		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, moist, with SILT, drills easily				
10			127	13.3	■	72
12						
14		***SILTY SAND (SM)*** Dense, fine- to medium-grained; brown, moist, with CLAY, drills easily	126	11.2	■	53
16						
18						
20		Very dense below 20 feet			■	



Drill Method: Solid Flight

Drill Rig:

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-2-15

Hole Size: 4½ Inches

Elevation: 633 Feet

Sheet: 1 of 2

Log of Boring B4

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-4

Location: Guzman, Kern County, CA

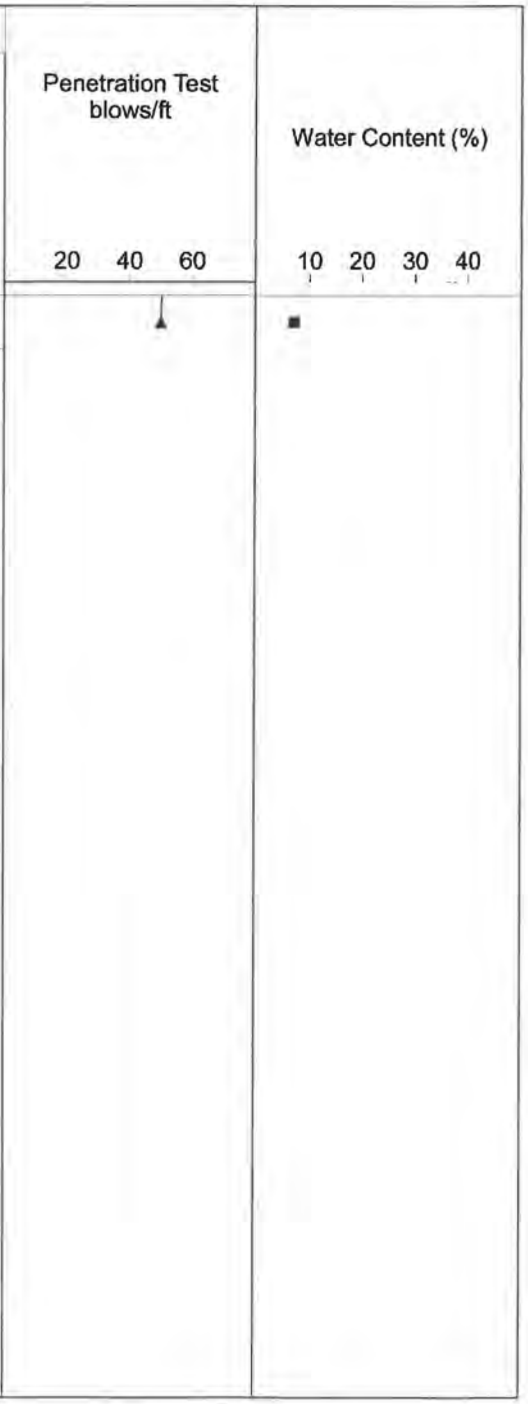
Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		132	7.1	■	50+
22	▨					
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight

Drill Date: 7-2-15

Drill Rig:

Krazan and Associates

Hole Size: 4½ Inches

Driller: Jim Watts

Elevation: 633 Feet

Sheet: 2 of 2

Log of Boring B5

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

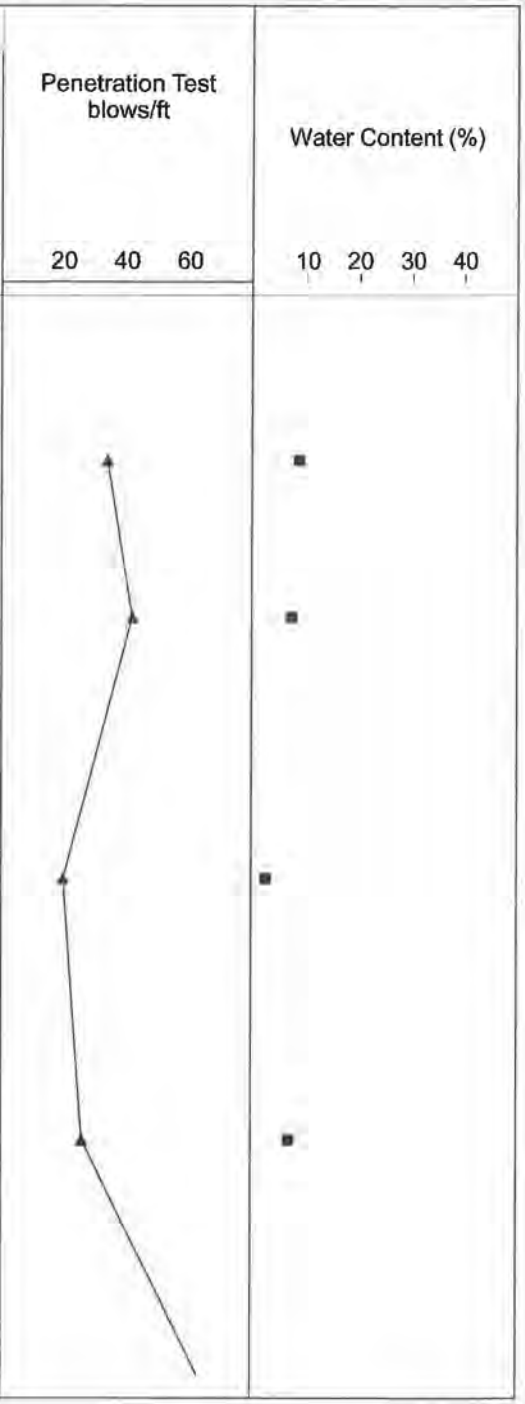
Project No: 022-15055

Figure No.: A-5

Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SANDY CLAY (CL)*** Stiff, fine- to medium-grained; brown, damp, drills easily				
2		Very stiff below 2 feet	103	8.3	■	34
4		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Dense, fine- to medium-grained; light brown, damp, drills easily	88.4	7.3	■	42
6						
8		***SAND (SP)*** Medium dense, fine- to coarse-grained; light brown, damp, drills easily				
10			120	2.7	■	20
12		***SANDY CLAY (CL)*** Very stiff, fine- to coarse-grained; brown, damp, with SILT, drills easily				
14						
		CLAYEY SAND (SC) Medium dense, fine- to coarse-grained; light brown, damp, drills easily	103	7.0	◢	26
16						
18						
20					◢	



Drill Method: Solid Flight

Drill Rig:

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-2-15

Hole Size: 4½ Inches

Elevation: 641 Feet

Sheet: 1 of 3

Log of Boring B5

Project: Guzman Reservoir
Project No: 022-15055

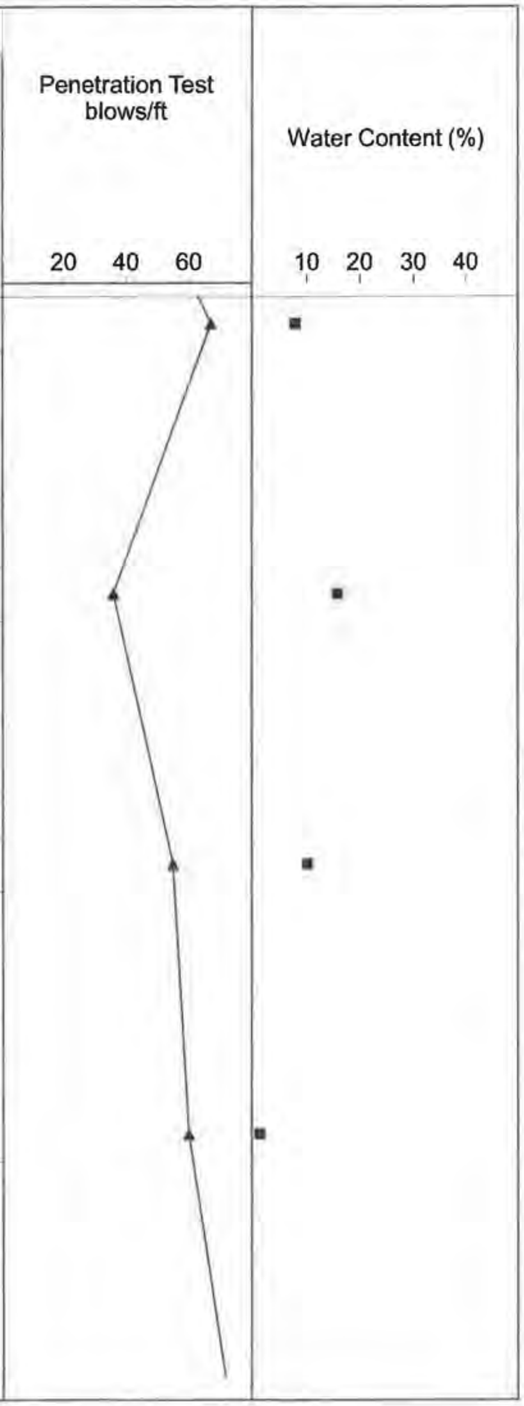
Client: Kern Tulare Water District
Figure No.: A-5

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE / SAMPLE

Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	SILTY SAND (SM) Very dense, fine- to medium-grained; brown, damp, with CLAY, drills easily	132	7.9	◢	67
22					
24					
	Medium dense and moist below 25 feet	111	15.9	◢	36
26					
28					
30	Very dense with minor CLAY below 30 feet	124	10.3	◢	55
32					
	SAND (SP) Very dense, fine- to coarse-grained; light brown, damp, drills easily				
34					
		116	1.5	◢	60
36					
38					
40				◢	



Drill Method: Solid Flight
Drill Date: 7-2-15

Drill Rig:

Krazan and Associates

Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 641 Feet

Log of Boring B5

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

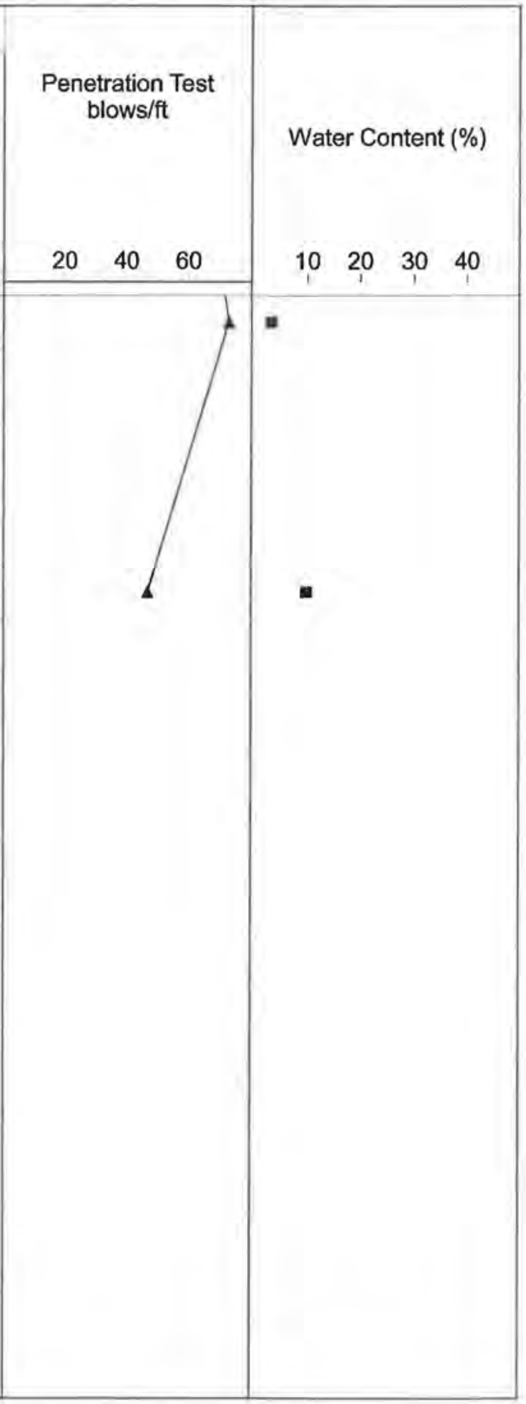
Figure No.: A-5

Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		111.5	3.6	◢	73
44	▨	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Dense to hard, fine- to medium-grained; brown, damp, drills easily				
	▨		125	10.0	◢	47
50		End of Borehole				



Drill Method: Solid Flight

Drill Date: 7-2-15

Drill Rig:

Krazan and Associates

Hole Size: 4½ Inches

Driller: Jim Watts

Elevation: 641 Feet

Sheet: 3 of 3

Log of Boring B6

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

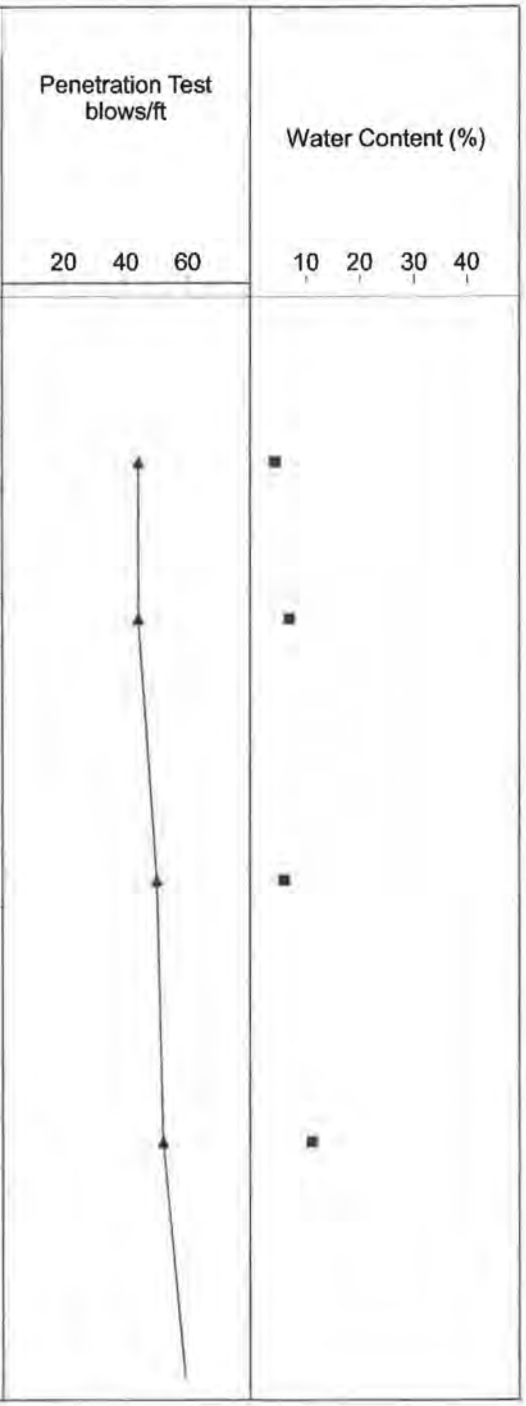
Project No: 022-15055

Figure No.: A-6

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Dense, fine- to medium-grained; dark brown, damp, drills easily	117	4.5	■	44
			103	7.1	■	44
8		***SILTY SAND (SM)*** Very dense, fine- to coarse-grained with trace CLAY; brown, damp, drills easily				
			126	6.2	■	50+
		Dense below 15 feet	128	11.4	■	52
18		***SAND (SP)*** Dense, fine- to coarse-grained; light brown, damp, drills easily				
20					■	[illegible]



Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 630 Feet

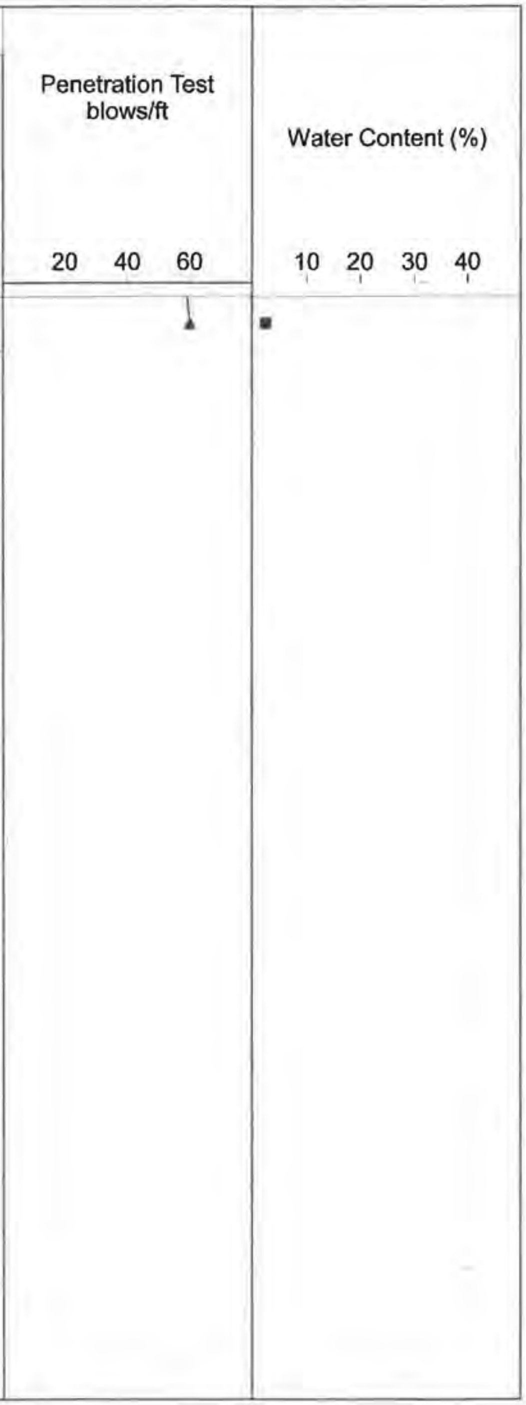
Sheet: 1 of 2

Log of Boring B6

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None

Project No: 022-15055
Figure No.: A-6
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		127	2.5	■	60
22	▨	***CLAYEY SAND (SC)*** Dense, fine- to coarse-grained; brown, damp, drills easily				
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight
Drill Rig: CME 55-2
Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15
Hole Size: 4½ Inches
Elevation: 630 Feet
Sheet: 2 of 2

Log of Boring B7

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

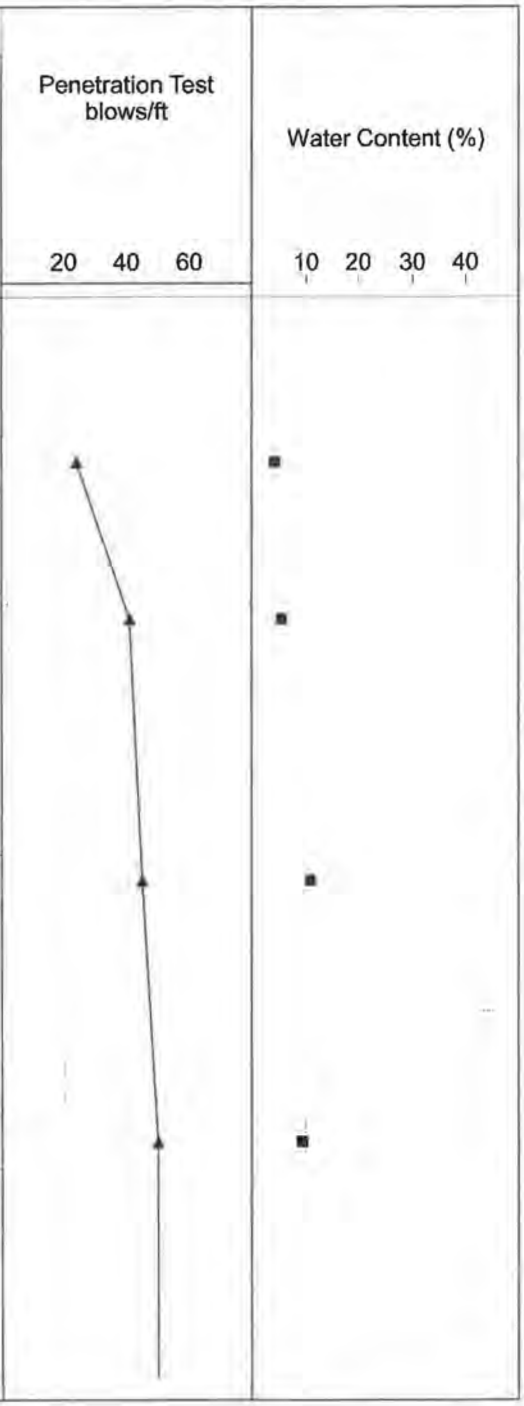
Project No: 022-15055

Figure No.: A-7

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2		***CLAYEY SAND (SC)*** Medium dense, fine- to medium-grained; dark brown, damp, drills easily	106	4.2	■	24
4						
		Dense below 5 feet	99	5.5	■	41
6						
		Brown below 7 feet				
8						
10		With higher CLAY content below 10 feet	129	10.9	■	45
12						
		SILTY SAND (SM) Very dense, fine- to medium-grained with trace CLAY; brown, moist, drills easily				
14						
			125	9.5	■	50+
16						
18						
20					■	



Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 632 Feet

Sheet: 1 of 2

Log of Boring B7

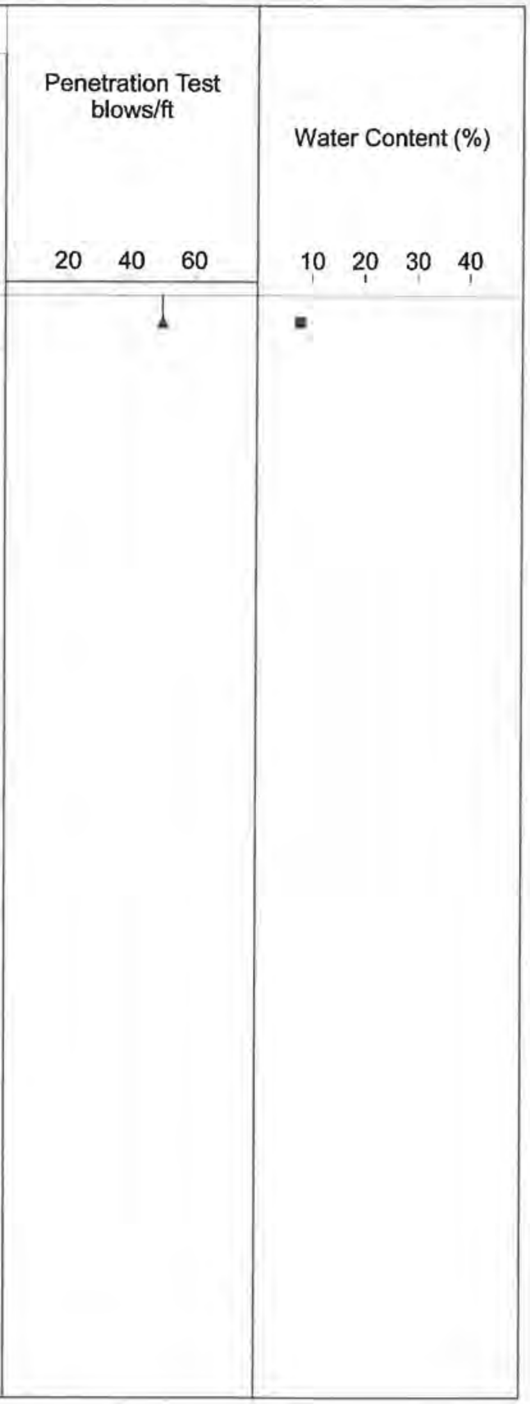
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-7

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		132	7.9	■	50+
22	▨					
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight
Drill Date: 7-1-15

Drill Rig: CME 55-2
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 632 Feet

Sheet: 2 of 2

Log of Boring B8

Project: Guzman Reservoir

Project No: 022-15055

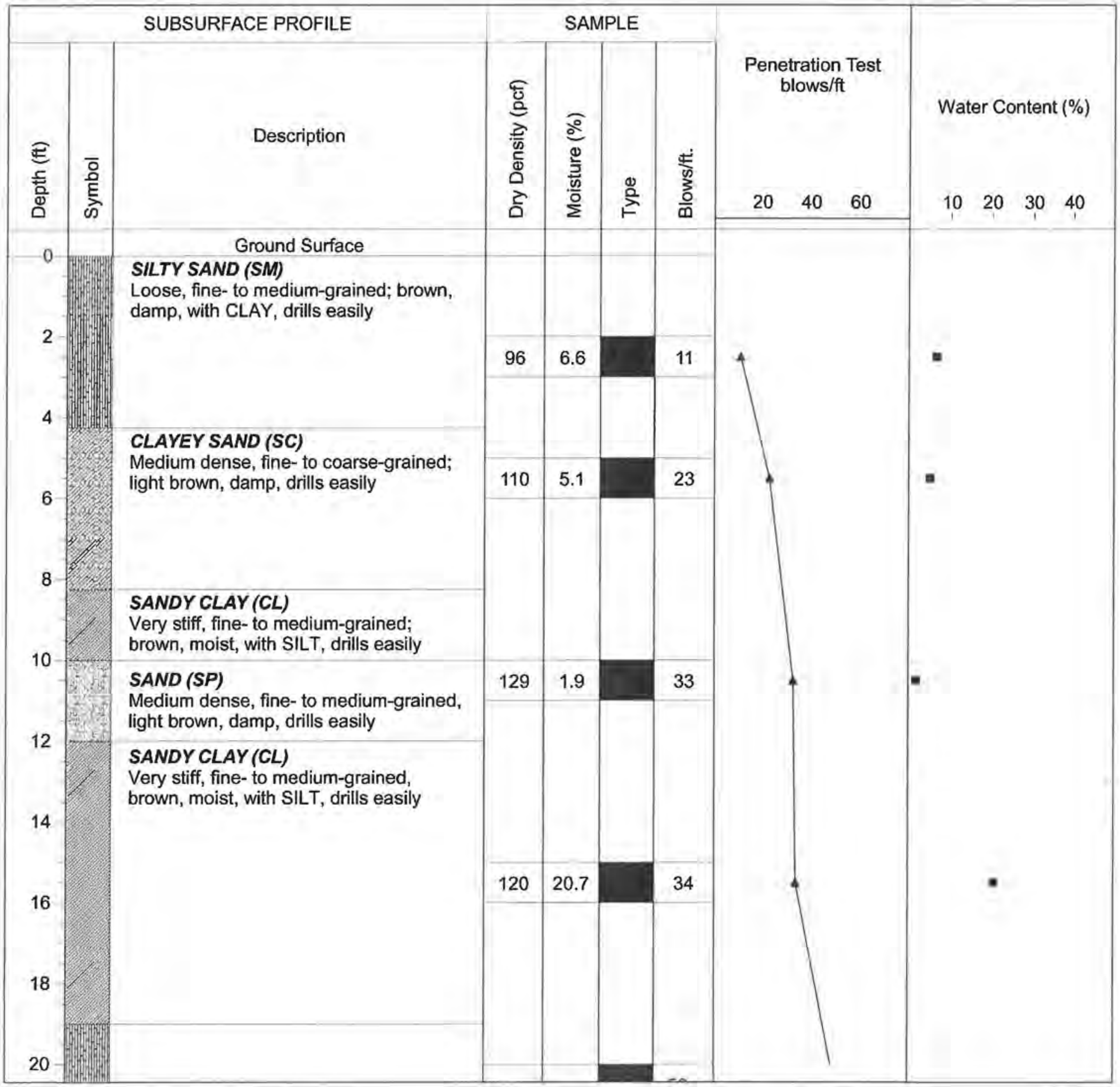
Client: Kern Tulare Water District

Figure No.: A-8

Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None



Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
Ground Surface				
SILTY SAND (SM) Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily	96	6.6	■	11
CLAYEY SAND (SC) Medium dense, fine- to coarse-grained; light brown, damp, drills easily	110	5.1	■	23
SANDY CLAY (CL) Very stiff, fine- to medium-grained; brown, moist, with SILT, drills easily				
SAND (SP) Medium dense, fine- to medium-grained, light brown, damp, drills easily	129	1.9	■	33
SANDY CLAY (CL) Very stiff, fine- to medium-grained, brown, moist, with SILT, drills easily	120	20.7	■	34

Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 636 Feet

Sheet: 1 of 2

Log of Boring B8

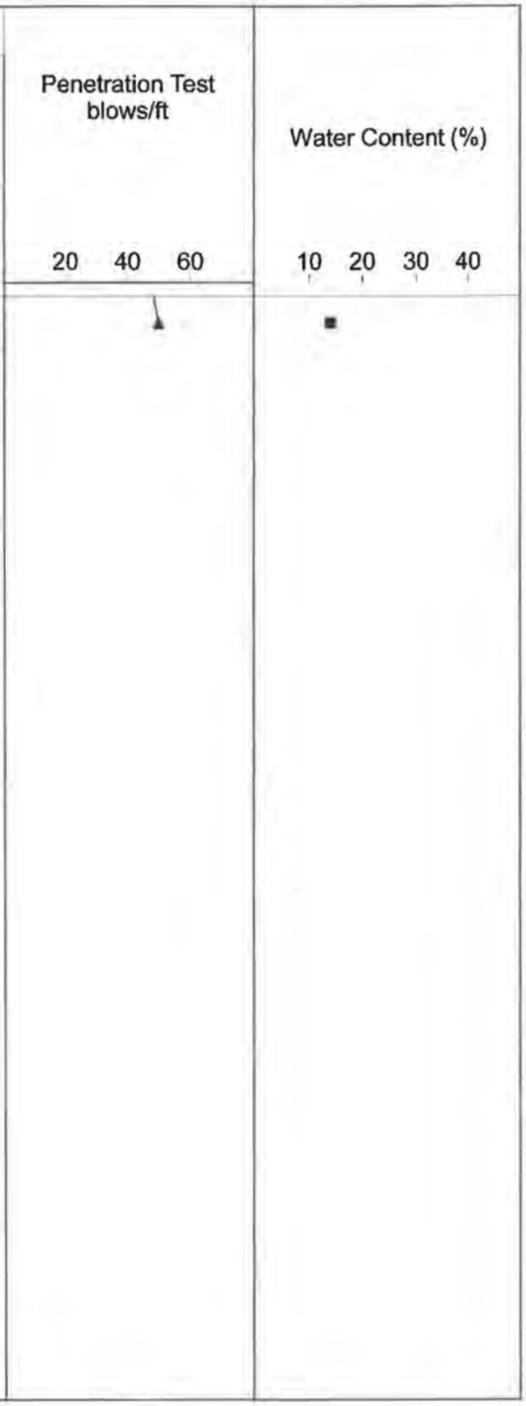
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-8

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨	***SILTY SAND (SM)*** Very dense, fine- to medium-grained; brown, damp, with CLAY, drills easily	127	14.1	■	50+
22	▨					
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight
Drill Date: 7-1-15

Drill Rig: CME 55-2
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 636 Feet

Sheet: 2 of 2

Log of Boring B9

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

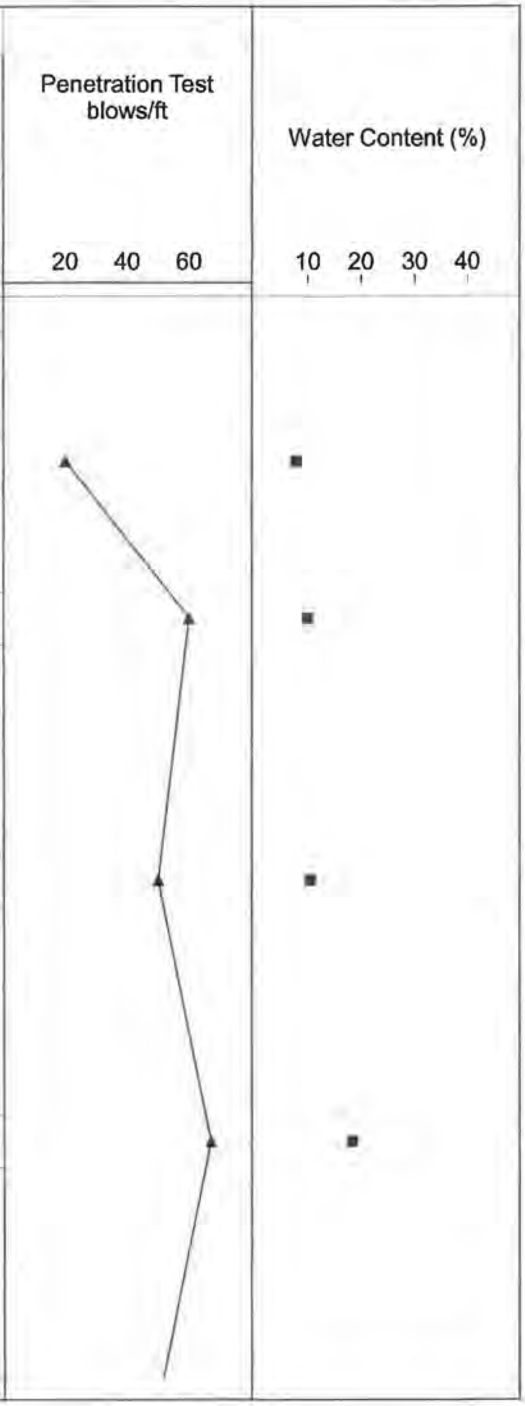
Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055

Figure No.: A-9

Logged By: Dave Adams

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily Medium dense below 2 feet				
2			94	8.0	■	20
4		***SANDY CLAY (CL)*** Loose, fine- to medium-grained; brown, damp, with SILT, drills easily	114	10.1	■	60
6						
8		***CLAYEY SAND (SC)*** Very dense, fine- to medium-grained; brown, damp, drills easily				
10			128	10.7	■	50+
12		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, moist, with SILT, drills easily				
14			121	18.6	■	67
16						
18						
20					■	



Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 648 Feet

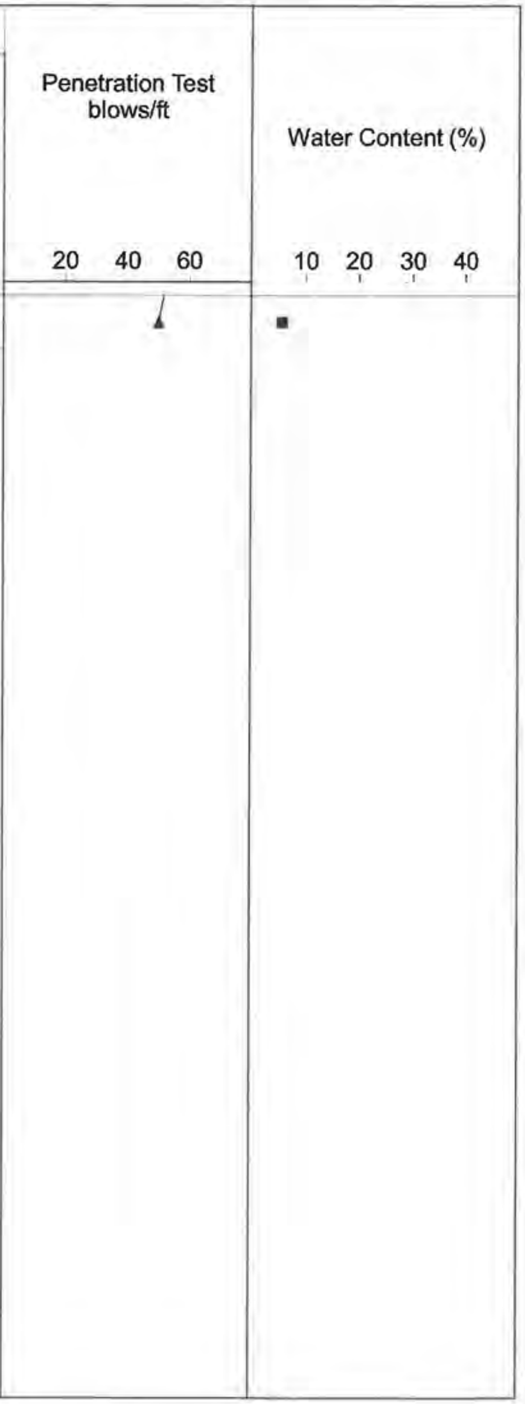
Log of Boring B9

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Project No: 022-15055
Figure No.: A-9
Logged By: Dave Adams

Initial: None
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨	***SAND (SP)*** Very dense, fine- to coarse-grained with trace CLAY; light brown, damp, drills easily	126	5.7	■	50+
22						
24						
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight
Drill Rig: CME 55-2
Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15
Hole Size: 4½ Inches
Elevation: 648 Feet
Sheet: 2 of 2

Log of Boring B10

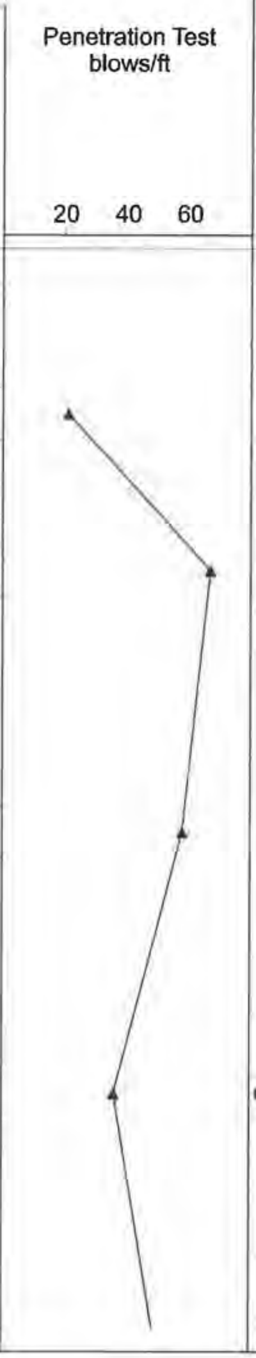
Project: Guzman Reservoir
Project No: 022-15055

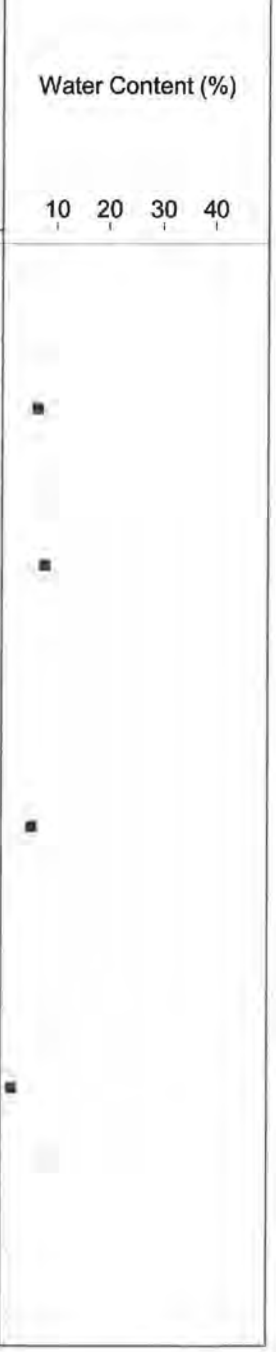
Client: Kern Tulare Water District
Figure No.: A-10

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
		Ground Surface				
0		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2		Medium dense below 2 feet	114	6.6	■	21
4		***CLAYEY SAND (SC)*** Very dense, fine- to coarse-grained; light brown, damp, drills easily				
			116	8.0	■	67
10		Dense below 10 feet	127	5.7	■	58
		SAND (SP) Medium dense, fine- to coarse-grained; light brown, damp, drills easily				
			123	2.1	■	36
20					■	





Drill Method: Solid Flight
Drill Date: 7-1-15

Drill Rig: CME 55-2
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 671 Feet

Sheet: 1 of 2

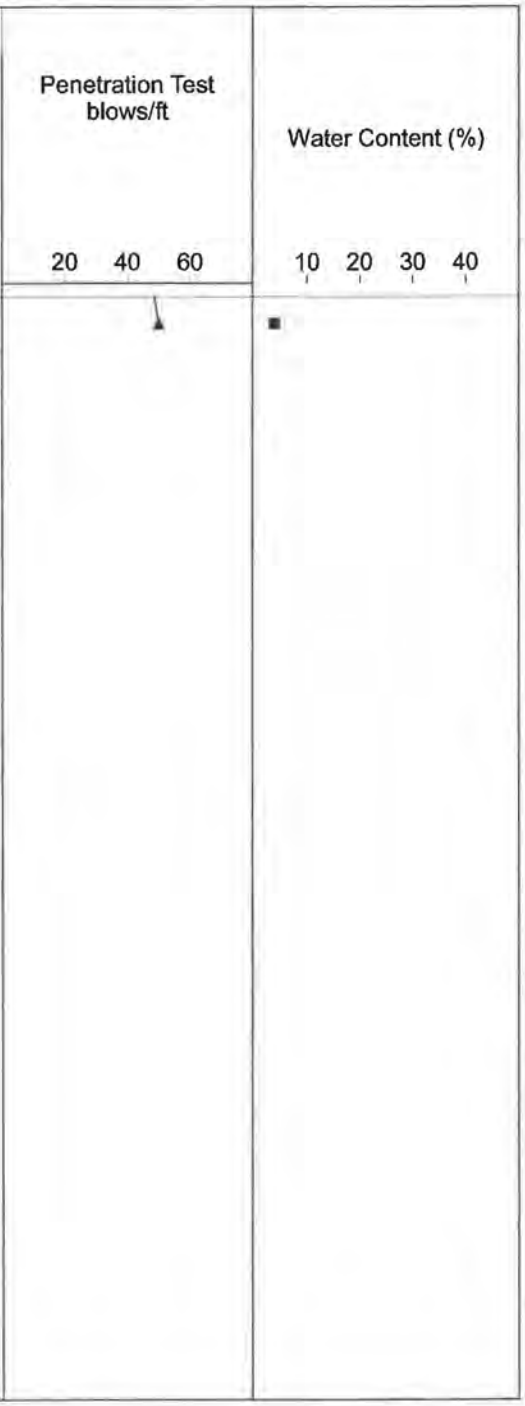
Log of Boring B10

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-10
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
	▨	***CLAYEY SAND (SC)*** Very dense, fine- to coarse-grained; brown, damp, drills easily	124	4.0	■	50+		
22	▨							
24	▨							
		End of Borehole						
26								
28								
30								
32								
34								
36								
38								
40								



Drill Method: Solid Flight
Drill Rig: CME 55-2
Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15
Hole Size: 4½ Inches
Elevation: 671 Feet
Sheet: 2 of 2

Log of Boring B11

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-11

Location: Guzman, Kern County, CA

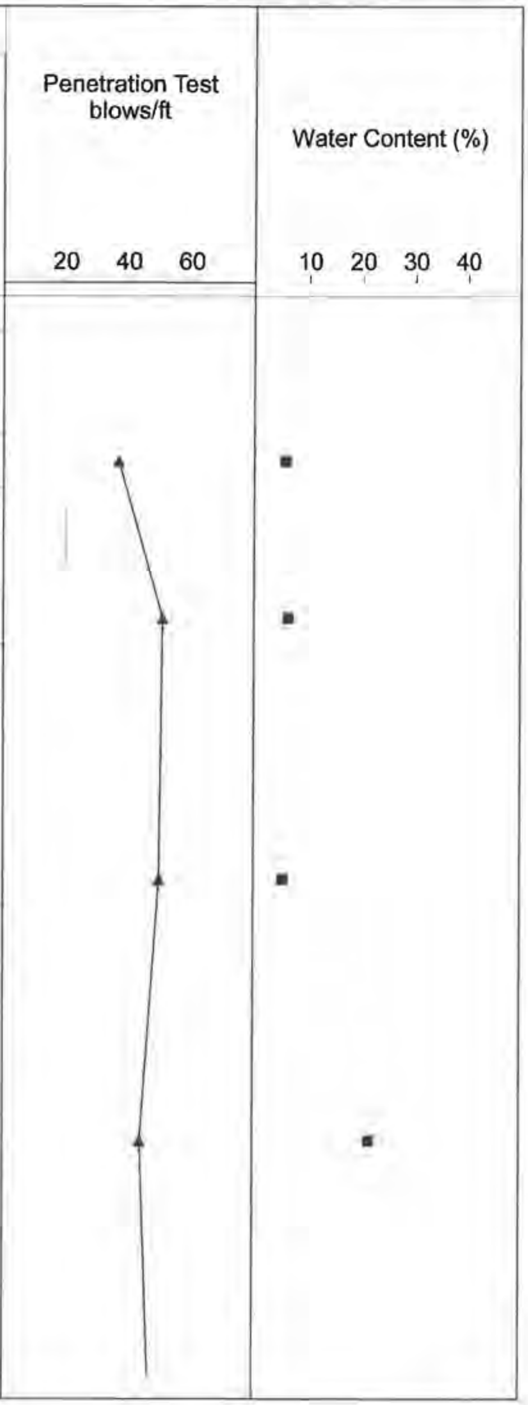
Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE		SAMPLE			
Depth (ft)	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0	Ground Surface				
0	***CLAYEY SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, drills easily				
2	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very stiff, fine- to medium-grained; dark brown, damp, drills easily	102	5.7	■	37
		93	6.2	■	51
8	***CLAYEY SAND (SC)*** Very dense, fine- to coarse-grained; brown, damp, drills easily				
10		121	5.4	■	50+
12	***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, moist, with SILT. drills easily				
		116	21.6	■	44
20				■	



Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 663 Feet

Sheet: 1 of 2

Log of Boring B11

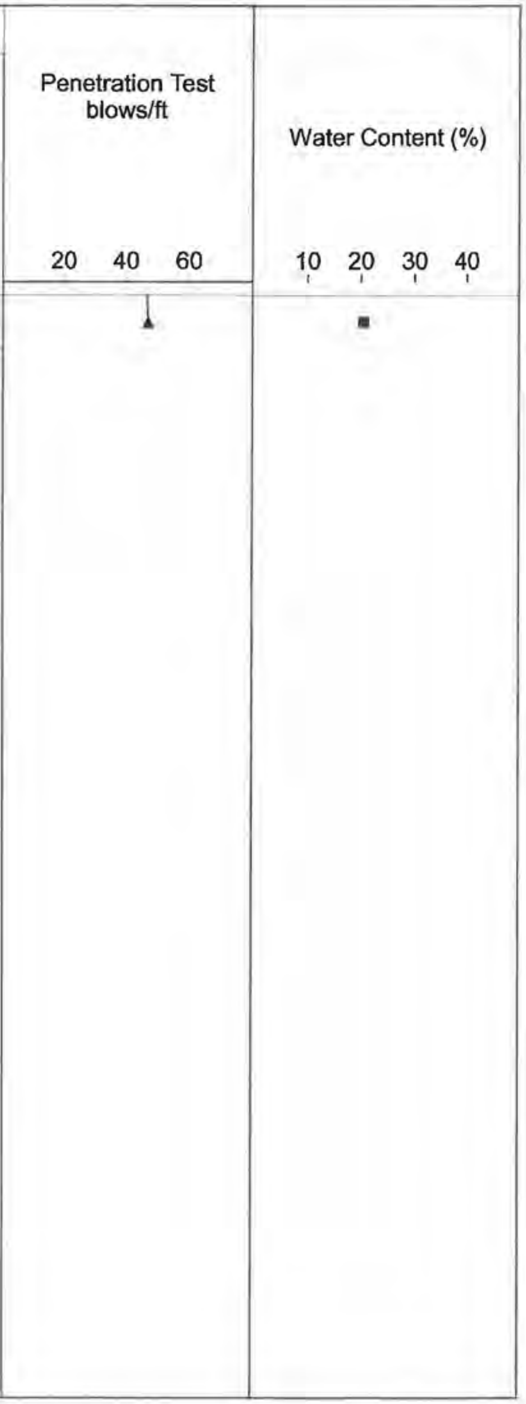
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-11

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		123	20.5	■	47
22	▨					
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight
Drill Date: 7-1-15

Drill Rig: CME 55-2
Krazan and Associates
Hole Size: 4½ Inches

Driller: Jim Watts
Elevation: 663 Feet

Log of Boring B12

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

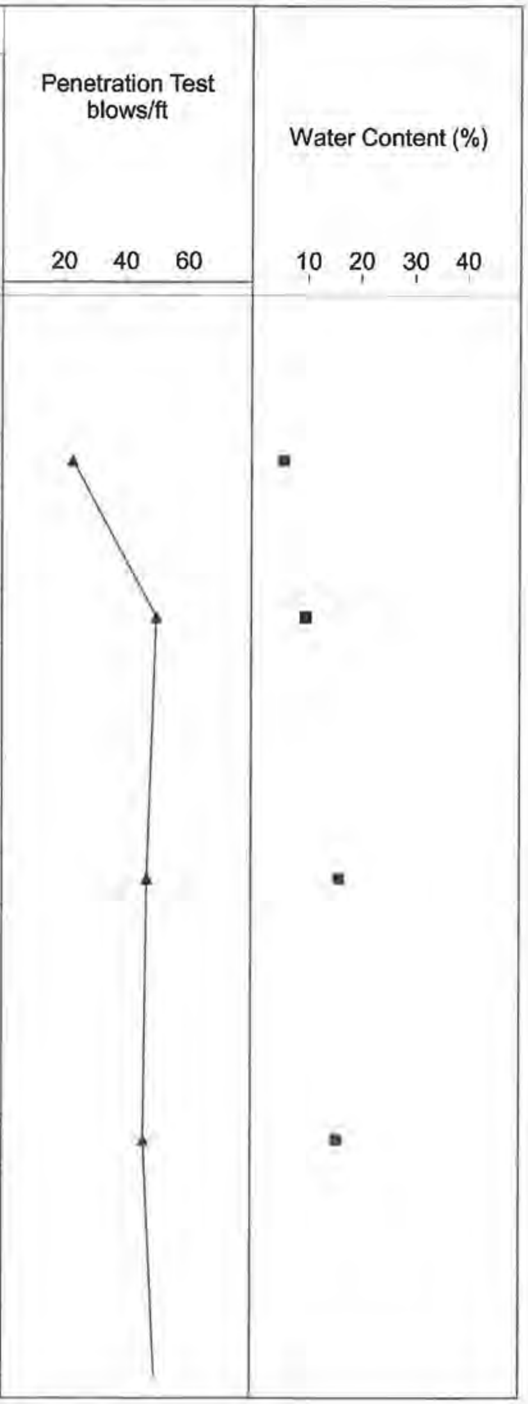
Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055

Figure No.: A-12

Logged By: Dave Adams

Depth (ft)	SUBSURFACE PROFILE Description	SAMPLE Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	Ground Surface				
0	***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, drills easily				
2	Medium dense below 2 feet	99	5.8	■	23
4					
6	Very dense below 5 feet	98	9.8	■	50+
8					
10	***SANDY CLAY (CL)*** Hard, fine- to medium-grained; reddish-brown, moist, with SILT, drills easily	124	16.1	■	47
12					
14					
16		126	15.8	■	46
18	***CLAYEY SAND (SC)*** Very dense, fine- to coarse-grained; brown, moist, drills easily				
20				■	



Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 651 Feet

Log of Boring B12

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

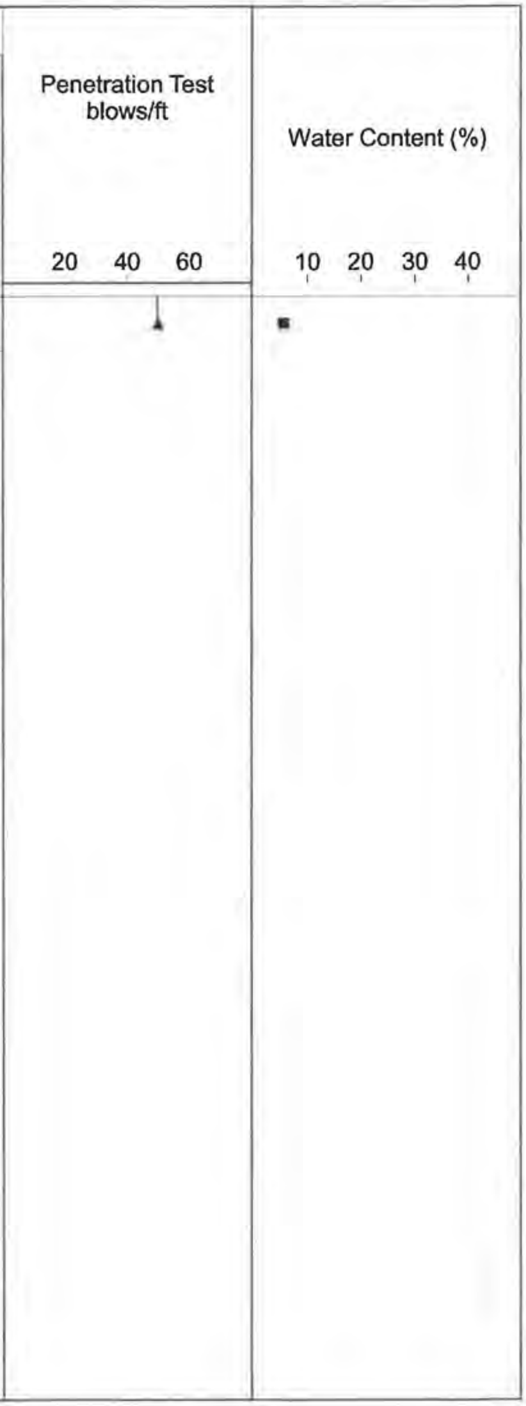
Project No: 022-15055

Figure No.: A-12

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
	▨		97	5.7	■	50+
22	▨					
24	▨					
		End of Borehole				
26						
28						
30						
32						
34						
36						
38						
40						



Drill Method: Solid Flight

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 7-1-15

Hole Size: 4½ Inches

Elevation: 651 Feet

Sheet: 2 of 2

Log of Boring B13

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None

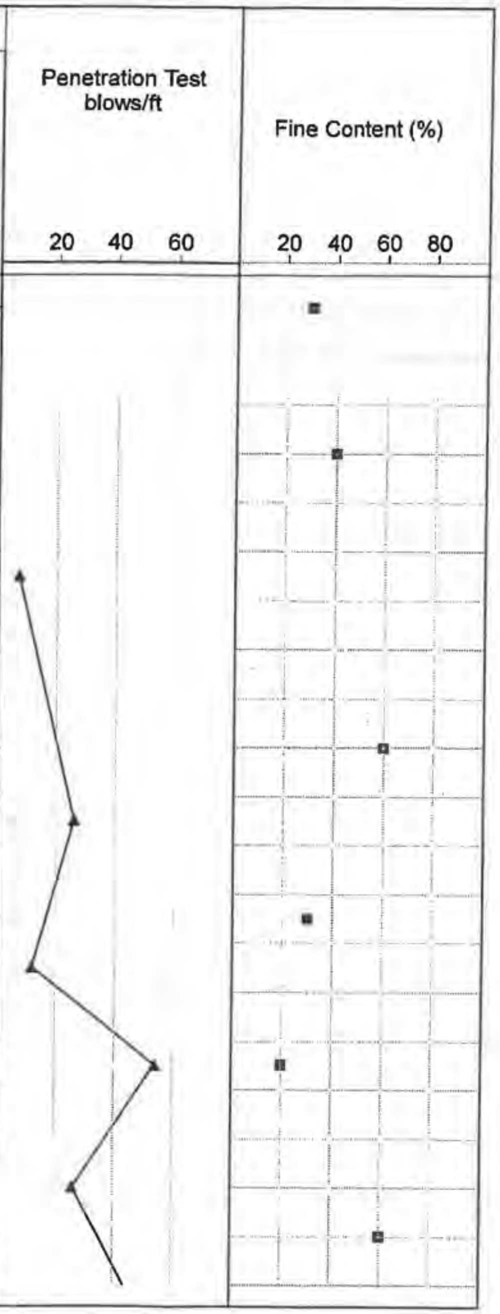
Project No: 022-15055

Figure No.: A-13

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
0		Ground Surface				
2	▥	***SILTY SAND (SM)*** Loose, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 30% fine content				
4	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; orangish-brown, damp, drills easily With approximately 40% fine content				
6			27	16	◢	7
8					▚	
10	▨	***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills tightly With approximately 60% fine content	27	14	◢	26
12						
14	▨	***CLAYEY SAND (SC)*** Dense, fine- to coarse-grained; brown, damp, drills easily With approximately 30% fine content			▚	
16	▥	***SILTY SAND (SM)*** Very dense, fine- to medium-grained; with clay, brown, damp, drills tightly With approximately 20% fine content	27	15	◢	54
18					▚	
20	▨				◢	



Drill Method: Hollow Stem

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 5-31-16

Hole Size: 6 Inches

Elevation: 665 Feet

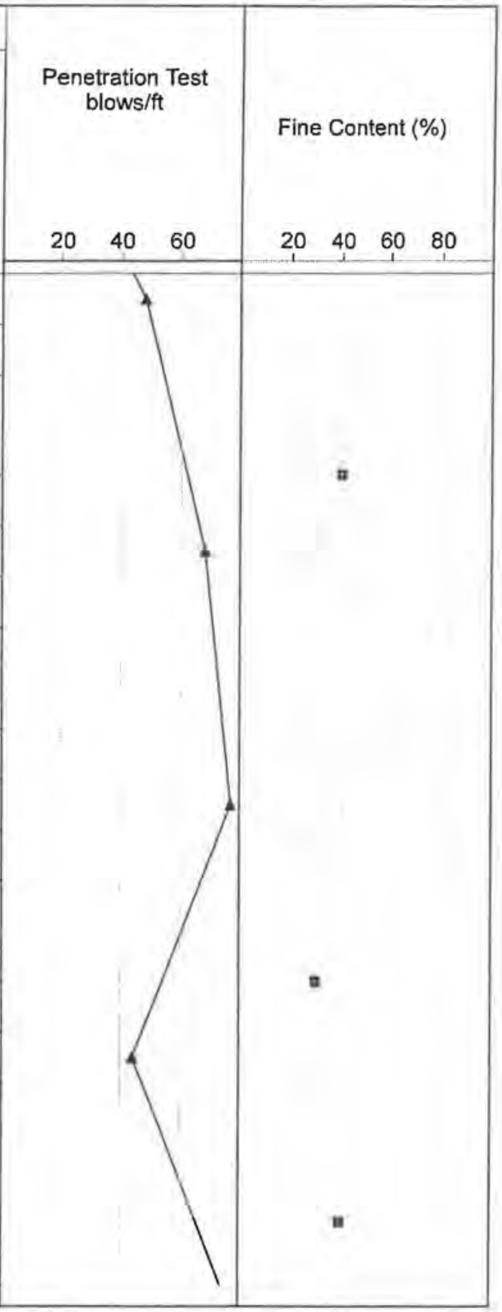
Sheet: 1 of 3

Log of Boring B13

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055
Figure No.: A-13
Logged By: Dave Adams

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
	▨	***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills tightly With approximately 60% fine content	27	16	◢	48
22	▨				▚	
24	▨	***SILTY SAND (SM)*** Very dense, well graded; with CLAY, light brown, damp, drills firmly With approximately 40% fine content	28	12	◢	68
26	▨					
28	▨				▚	
30	▨		26	10	◢	77
32	▨				▚	
34	▨	***SILTY SAND (SM)*** Dense, fine- to medium-grained; with CLAY, brown, damp, drills firmly With approximately 30% fine content	27	16	◢	44
36	▨					
38	▨					
40	▨				◢	



Drill Method: Hollow Stem
Drill Rig: CME 55-2
Driller: Jim Watts

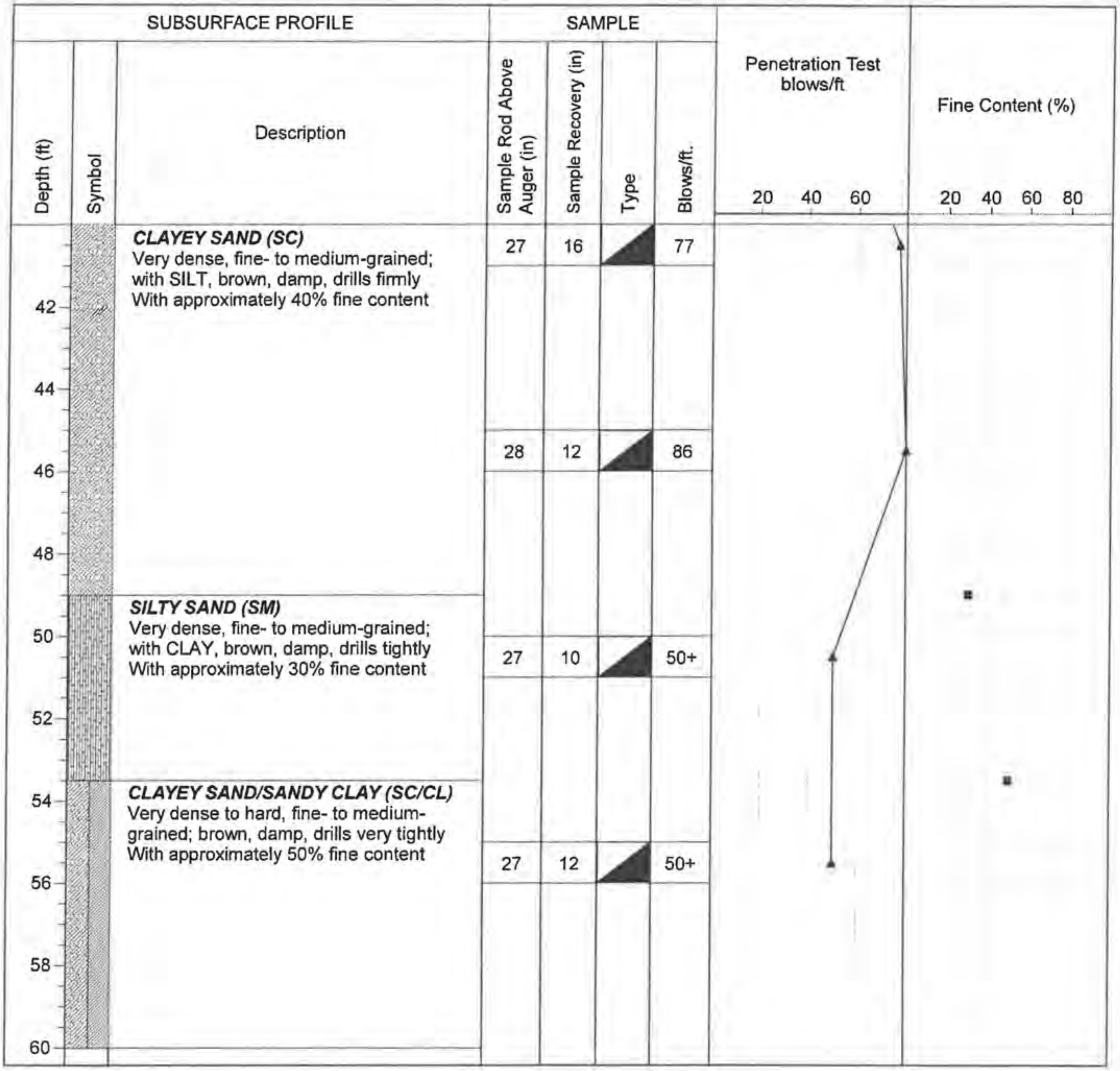
Krazan and Associates

Drill Date: 5-31-16
Hole Size: 6 Inches
Elevation: 665 Feet
Sheet: 2 of 3

Log of Boring B13

Project: Guzman Reservoir
Project No: 022-15055
Client: Kern Tulare Water District
Figure No.: A-13
Location: Guzman, Kern County, CA
Logged By: Dave Adams
Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE	SAMPLE			
Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
CLAYEY SAND (SC) Very dense, fine- to medium-grained; with SILT, brown, damp, drills firmly With approximately 40% fine content	27	16	◢	77
	28	12	◢	86
SILTY SAND (SM) Very dense, fine- to medium-grained; with CLAY, brown, damp, drills tightly With approximately 30% fine content	27	10	◢	50+
CLAYEY SAND/SANDY CLAY (SC/CL) Very dense to hard, fine- to medium-grained; brown, damp, drills very tightly With approximately 50% fine content	27	12	◢	50+



Drill Method: Hollow Stem
Drill Date: 5-31-16
Drill Rig: CME 55-2
Hole Size: 6 Inches
Driller: Jim Watts
Elevation: 665 Feet

Krazan and Associates

Sheet: 3 of 3

Log of Boring B14

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None

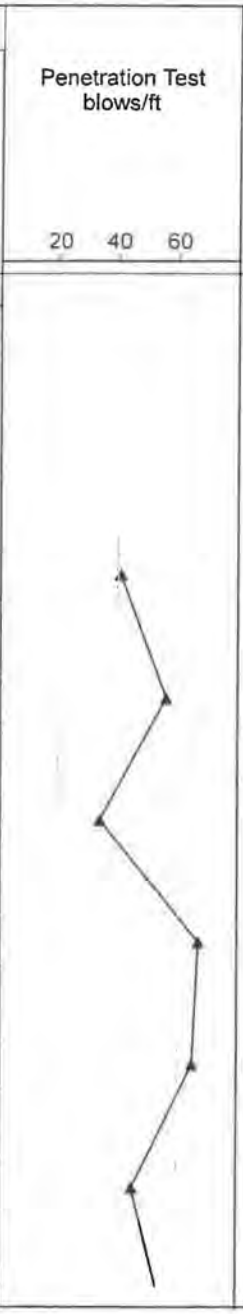
Project No: 022-15055

Figure No.: A-14

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
0		Ground Surface				
2	▨	***SILTY SAND (SM)*** Loose, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 30% fine content				
4	▨	***CLAYEY SAND (SC)*** Dense, fine- to coarse-grained; brown, damp, drills easily	26	16	◢	41
6	▨	With approximately 30% fine content				
8	▨	Very dense below 7½ feet	25	8	◢	56
10	▨	***SILTY SAND (SM)*** Dense, fine- to medium-grained; with CLAY; brown, damp, drills firmly	27	10	◢	34
12	▨	With approximately 20% fine content Very dense below 12 feet				
	▨		27	9	◢	67
14	▨					
16	▨	With approximately 30% fine content below 15 feet	27	12	◢	65
18	▨	***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills easily With approximately 70% fine content	27	20	◢	45
20	▨				◢	



Drill Method: Hollow Stem

Drill Rig: CME 55-2

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-1-16

Hole Size: 6 Inches

Elevation: 659 Feet

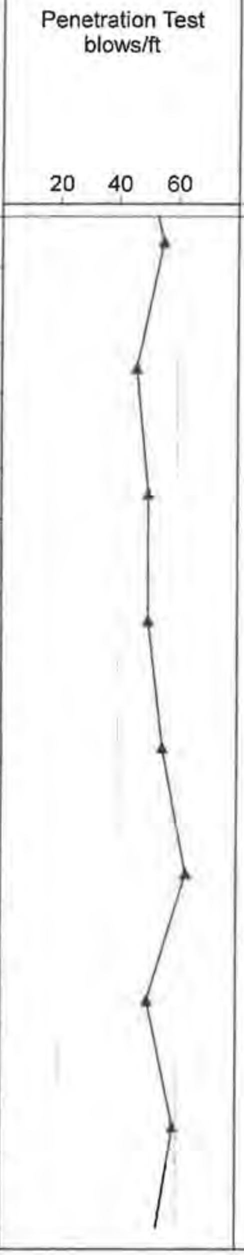
Log of Boring B14

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None

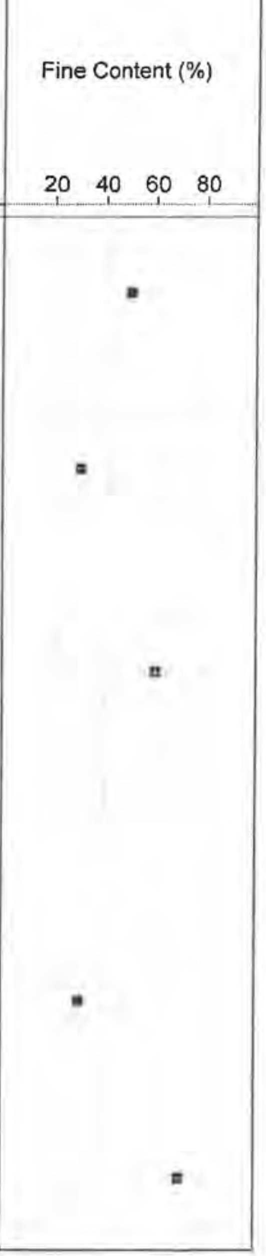
Project No: 022-15055
Figure No.: A-14
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
			27	18	◢	55
22		***SILTY SAND/SANDY SILT (SM/ML)*** Dense, fine- to coarse-grained; with CLAY, brown, damp, drills firmly With approximately 50% fine content				
			27	14	◢	46
24						
		SILTY SAND (SM) Very dense, fine- to medium-grained; with minor CLAY; brown, damp, drills firmly With approximately 30% sand content	28	9	◢	50+
26						
28			27	17	◢	50+
		SANDY CLAY (CL) Hard, fine- to medium-grained; brown, damp, drills tightly With approximately 60% fine content				
30			28	18	◢	55
32						
			27	18	◢	63
34						
			27	17	◢	50+
36		***CLAYEY SAND (SC)*** Very dense, well graded; brown, damp, drills firmly With approximately 30% fine content				
38			28	8	◢	59
40					◢	

Penetration Test blows/ft



Fine Content (%)



Drill Method: Hollow Stem
Drill Rig: CME 55-2
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-1-16
Hole Size: 6 Inches
Elevation: 659 Feet
Sheet: 2 of 4

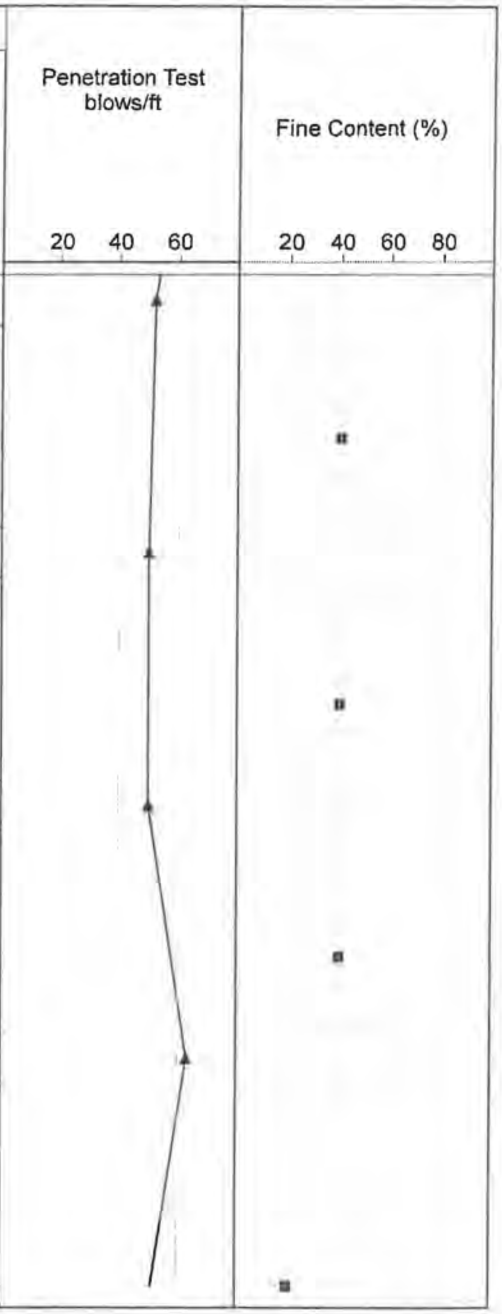
Log of Boring B14

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-14
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
		SANDY SILT (ML) Very dense, fine- to medium-grained; with CLAY, brown, damp, drills tightly With approximately 70% fine content	27	17	◢	52
42						
44		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; with CLAY, brown, damp, drills firmly With approximately 40% fine content	27	17	◢	50+
46						
48						
50		***CLAYEY SAND (SC)*** Dense to very dense, fine- to medium-grained; brown, damp, drills very tightly With approximately 40% fine content	27	16	◢	50
52						
54		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; brown, damp, drills easily With approximately 40% fine content	27	15	◢	63
56						
58						
60					◢	



Drill Method: Hollow Stem
Drill Rig: CME 55-2
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-1-16
Hole Size: 6 Inches
Elevation: 659 Feet
Sheet: 3 of 4

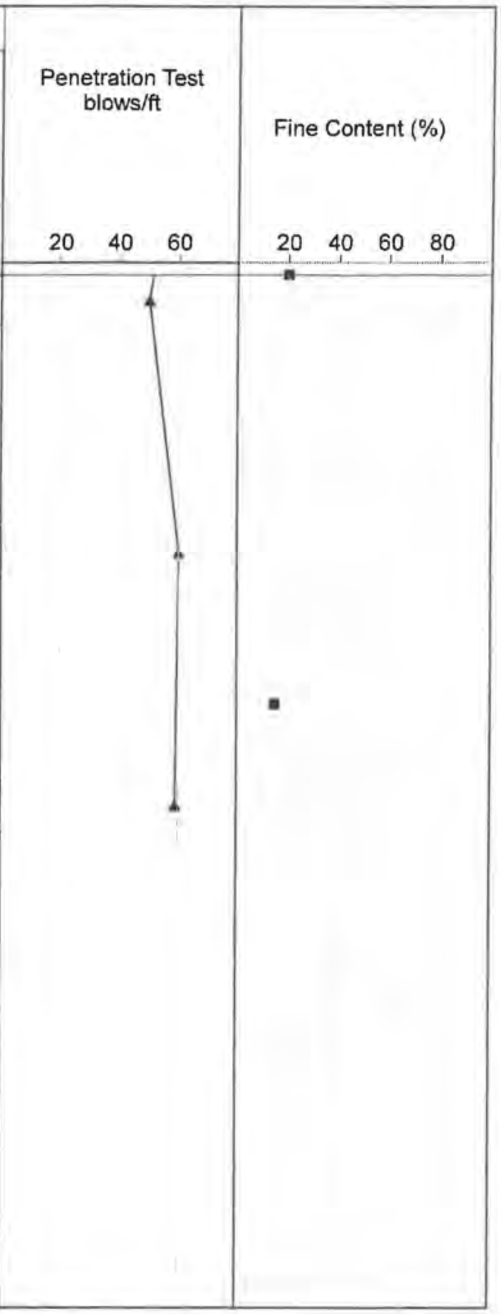
Log of Boring B14

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-14
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
	▨	***CLAYEY SAND (SC)*** Very dense, fine- to coarse-grained; light brown, damp, drills very firmly With approximately 20% fine content	28	6	◣	50+
62 64	▨					
66 68	▨		27	15	◣	60
70	▨	***SILTY SAND (SM)*** Very dense, well graded; with minor CLAY, light brown, damp, drills firmly With approximately 15% fine content	27	10	◣	59
72 74	▨					
76 78 80		End of Borehole				



Drill Method: Hollow Stem
Drill Rig: CME 55-2
Driller: Jim Watts

Krazan and Associates

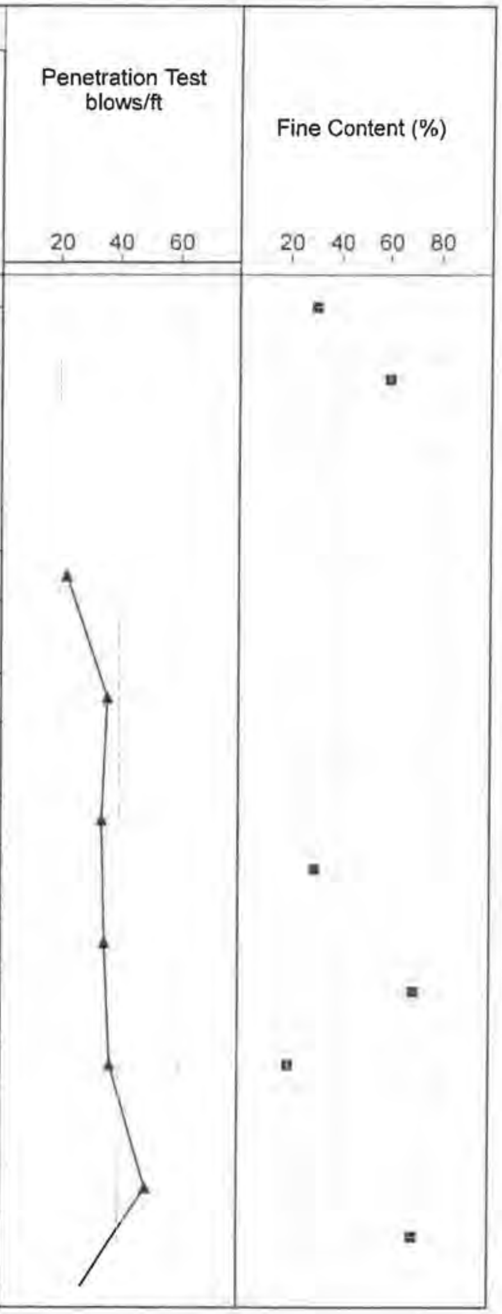
Drill Date: 6-1-16
Hole Size: 6 Inches
Elevation: 659 Feet
Sheet: 4 of 4

Log of Boring B15

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None

Project No: 022-15055
Figure No.: A-15
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft
0		Ground Surface				
2		***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content				
4		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills easily With approximately 60% fine content				
6			27	13	◢	22
8			26	15	◢	36
10			27	15	◢	34
12		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; with CLAY; brown, damp, drills easily With approximately 30% fine content	26	16	◢	35
14		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills easily With approximately 70% fine content	27	14	◢	37
16 18		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 20% fine content	26	14	◢	49
20					◢	



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

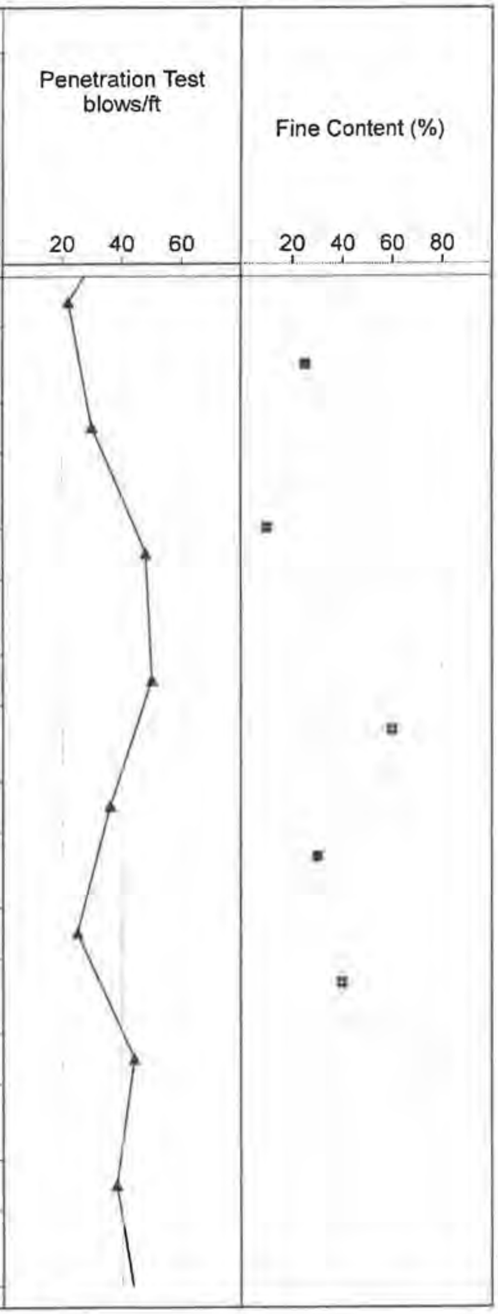
Drill Date: 6-6-16
Hole Size: 6 Inches
Elevation: 653 Feet
Sheet: 1 of 4

Log of Boring B15

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>
Initial: None

Project No: 022-15055
Figure No.: A-15
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
		SANDY SILT (ML) Medium dense, fine- to medium-grained; with CLAY, brown, moist, drills easily With approximately 70% fine content	27	17	◢	22
22						
		SILTY SAND (SM) Medium dense, well graded; brown, damp, drills easily With approximately 25% fine content	26	15	◢	30
24						
		SAND/SILTY SAND (SW-SM) Dense, well graded; light brown, damp, drills easily With approximately 10% fine content	28	12	◢	48
26						
28			27	11	◢	50
		SANDY SILT (ML) Medium dense, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 60% fine content				
30			25	17	◢	36
32		***SILTY SAND (SM)*** Medium dense, well graded; brown, damp, drills easily With approximately 30% fine content				
			27	15	◢	25
34		***SILTY SAND (SM)*** Dense, well graded; with minor GRAVEL; light brown, damp, drills easily With approximately 40% fine content				
			27	13	◢	44
36						
38			28	8	◢	38
40					◢	



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

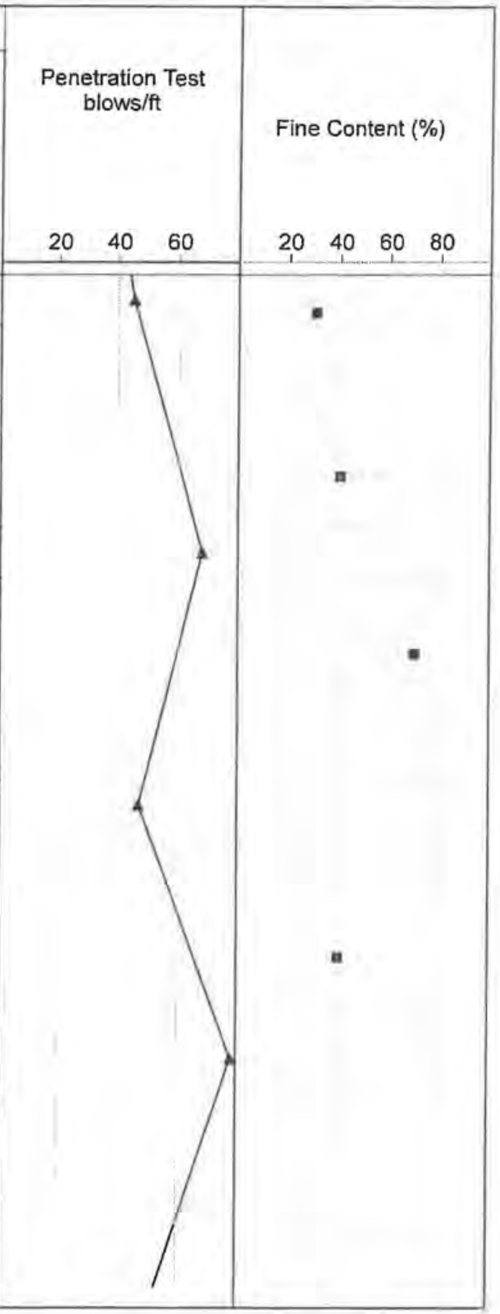
Drill Date: 6-6-16
Hole Size: 6 Inches
Elevation: 653 Feet

Log of Boring B15

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055
Figure No.: A-15
Logged By: Dave Adams

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
			28	13	◢	45
42		***SILTY SAND (SM)*** Dense, fine- to medium-grained; brown, damp, drills firmly With approximately 30% fine content				
44		***CLAYEY SAND (SC)*** Very dense, fine- to medium-grained; brown, damp, drills firmly With approximately 40% fine content	25	15	◢	68
46						
48		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills tightly With approximately 70% fine content				
50			24	14	◢	47
52						
54		***CLAYEY SAND (SC)*** Very dense, fine- to medium-grained; brown, damp, drills very firmly With approximately 40% fine content	25	15	◢	78
56						
58						
60					◢	



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

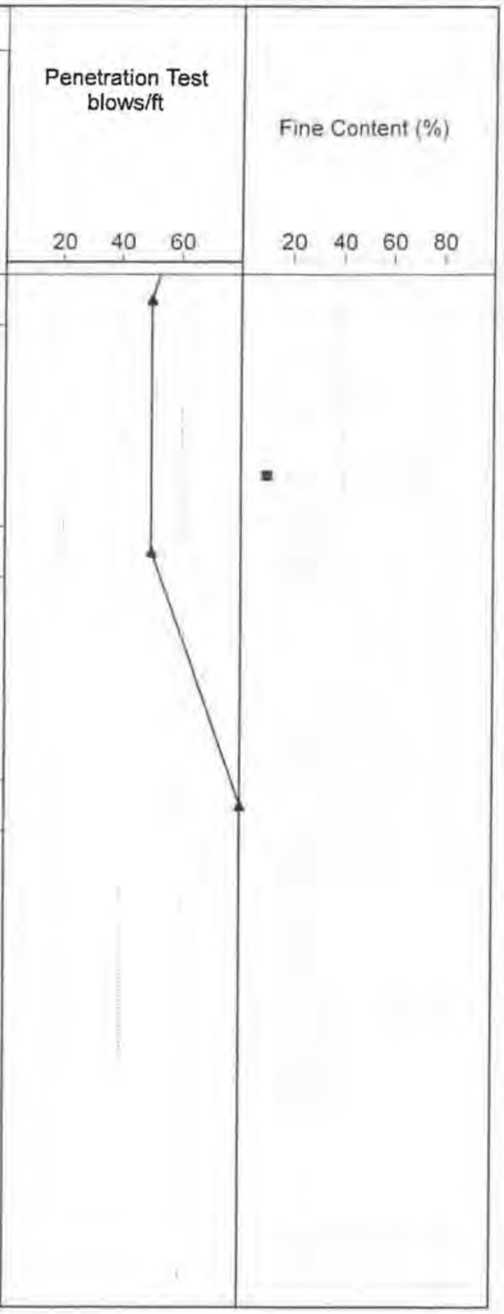
Drill Date: 6-6-16
Hole Size: 6 Inches
Elevation: 653 Feet
Sheet: 3 of 4

Log of Boring B15

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055
Figure No.: A-15
Logged By: Dave Adams

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
	▨		24	12	◢	50+
62	▨					
64	▥	***SAND/SILTY SAND (SW-SM)*** Very dense, well graded; light brown, damp, drills hard With approximately 10% fine content				
	▥		26	7	◢	50+
66	▥					
68	▥					
70	▥		24	15	◢	81
72	▥					
74	▥					
76		End of Borehole				
78						
80						



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-6-16
Hole Size: 6 Inches
Elevation: 653 Feet

Log of Boring B16

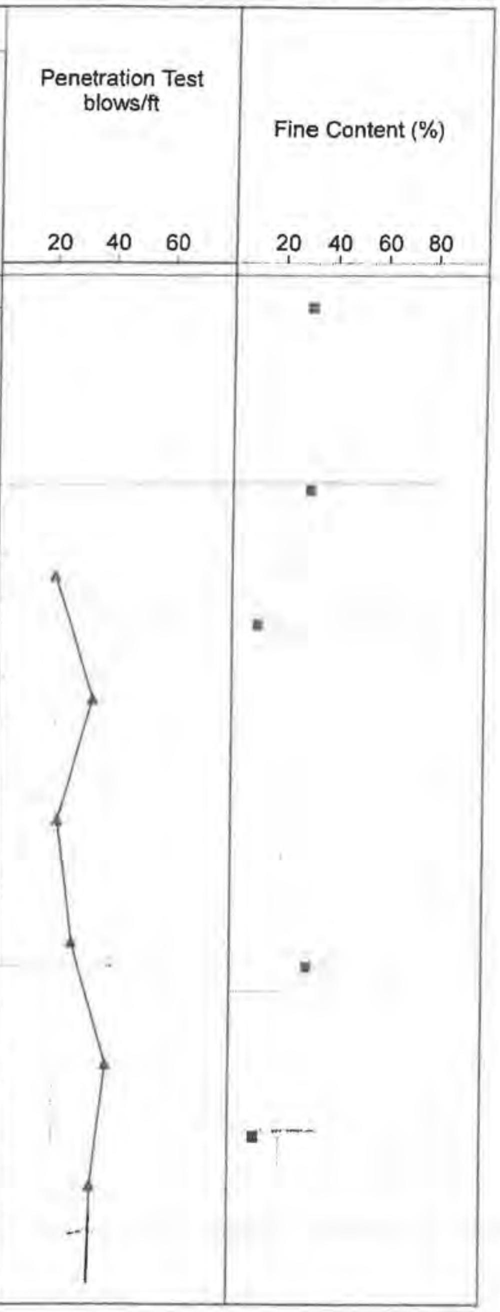
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-16

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
		Ground Surface				
0	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content				
4	▨	***SILTY SAND (SM)*** Medium dense, fine- tom edium-grained; with CLAY; brown, damp, drills easily With approximately 30% fine content	29	9	◢	20
8	▨	***SAND/SILTY SAND (SW-SM)*** Dense, well graded; with CLAY and minor GRAVEL; brown, damp, drills easily With approximately 10% fine content	29	14	◢	33
10			27	14	◢	21
12			27	13	◢	26
14	▨	***SILTY SAND (SM)*** Dense, fine- to medium-grained; with CLAY; brown, damp, drills firmly With approximately 30% fine content With minor GRAVEL below 15 feet	28	17	◢	38
18	▨	***SAND/SILTY SAND (SW-SM)*** Dense, well graded; with minor CLAY, brown, damp, drills easily With approximately 10% fine content	28	17	◢	33
20					◢	



Drill Method: Hollow Stem
Drill Date: 6-9-16

Drill Rig: CME 45C-3
Krazan and Associates
Hole Size: 6 Inches

Driller: Jim Watts
Elevation: 644 Feet

Log of Boring B16

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055

Figure No.: A-16

Logged By: Dave Adams

SUBSURFACE PROFILE

Depth (ft): 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

SANDY SILT (ML)
Medium dense, fine- to medium-grained; with CLAY; brown, damp, drills firmly
With approximately 60% fine content

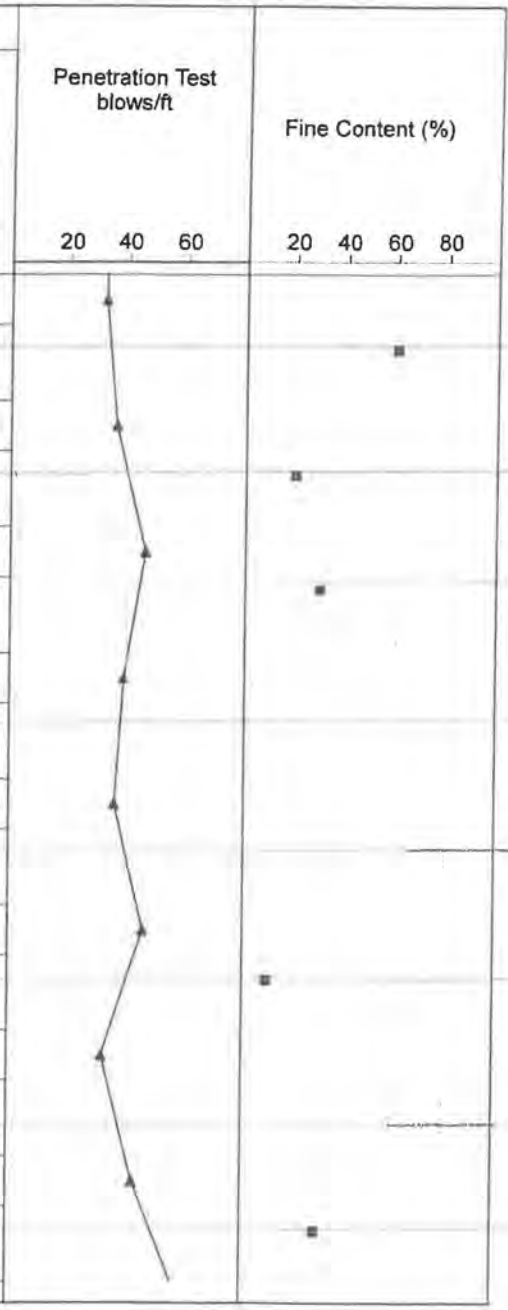
CLAYEY SAND (SC)
Medium dense, well graded; brown, damp, drills easily
With approximately 20% fine content

SILTY SAND (SM)
Dense, fine- to medium-grained; brown, damp, drills easily
With approximately 30% fine content

SAND/SILTY SAND (SW/SM)
Dense, well graded; light brown, damp, drills easily
With approximately 10% fine content

SAMPLE

Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
28	13	◢	32
28	16	◢	36
27	15	◢	29
25	14	◢	36
25	16	◢	39
28	16	◢	36
24	12	◢	46
25	15	◢	32
		◢	



Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-9-16

Hole Size: 6 Inches

Elevation: 644 Feet

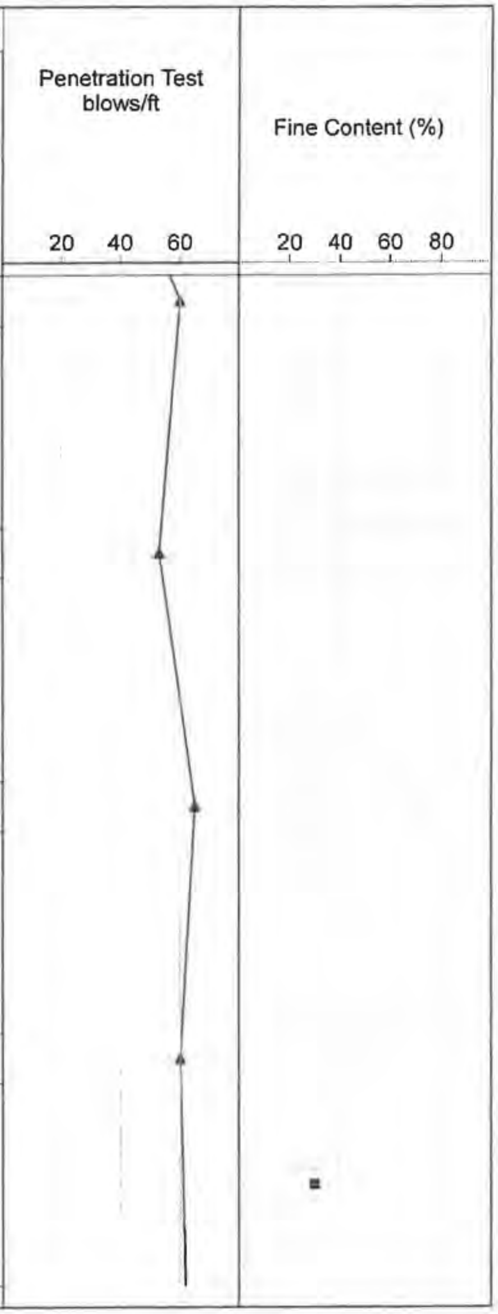
Sheet: 2 of 4

Log of Boring B16

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None

Project No: 022-15055
Figure No.: A-16
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
	▨	***SILTY SAND (SM)*** Dense, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content	25	17	◢	43
42	▨					
44	▨					
	▨		24	17	◢	60
46	▨					
48	▨					
50	▨					
	▨		24	17	◢	53
52	▨					
54	▨					
	▨		25	16	◢	65
56	▨					
58	▨	***CLAYEY SAND (SC)*** Very dense, fine- to medium-grained; brown, damp, drills very tightly With approximately 30% fine content				
60	▨				◢	



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-9-16
Hole Size: 6 Inches
Elevation: 644 Feet
Sheet: 3 of 4

Log of Boring B16

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None

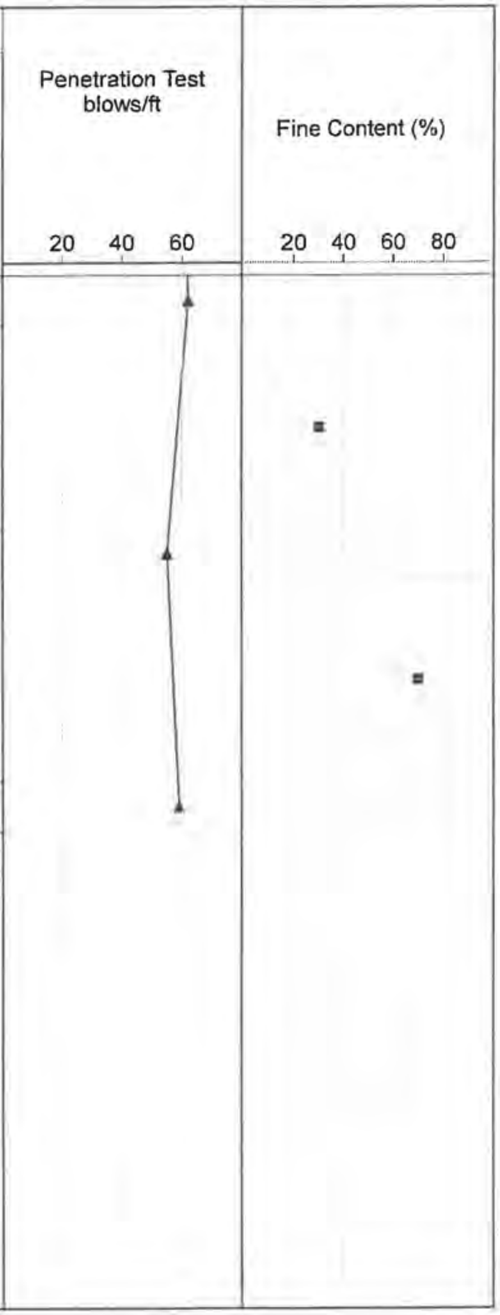
Project No: 022-15055

Figure No.: A-16

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
			28	15	◢	60
62						
64		***SAND/SILTY SAND (SW-SM)*** Very dense, well graded; with minor CLAY, light brown, damp, drills hard With approximately 30% fine content				
			26	12	◢	62
66						
68		***SANDY SILT (ML)*** Very dense, fine- to medium-grained; with CLAY, brown, moist, drills tightly With approximately 70% fine content				
70			25	15	◢	55
72						
74						
		End of Borehole				
76						
78						
80						



Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-9-16

Hole Size: 6 Inches

Elevation: 644 Feet

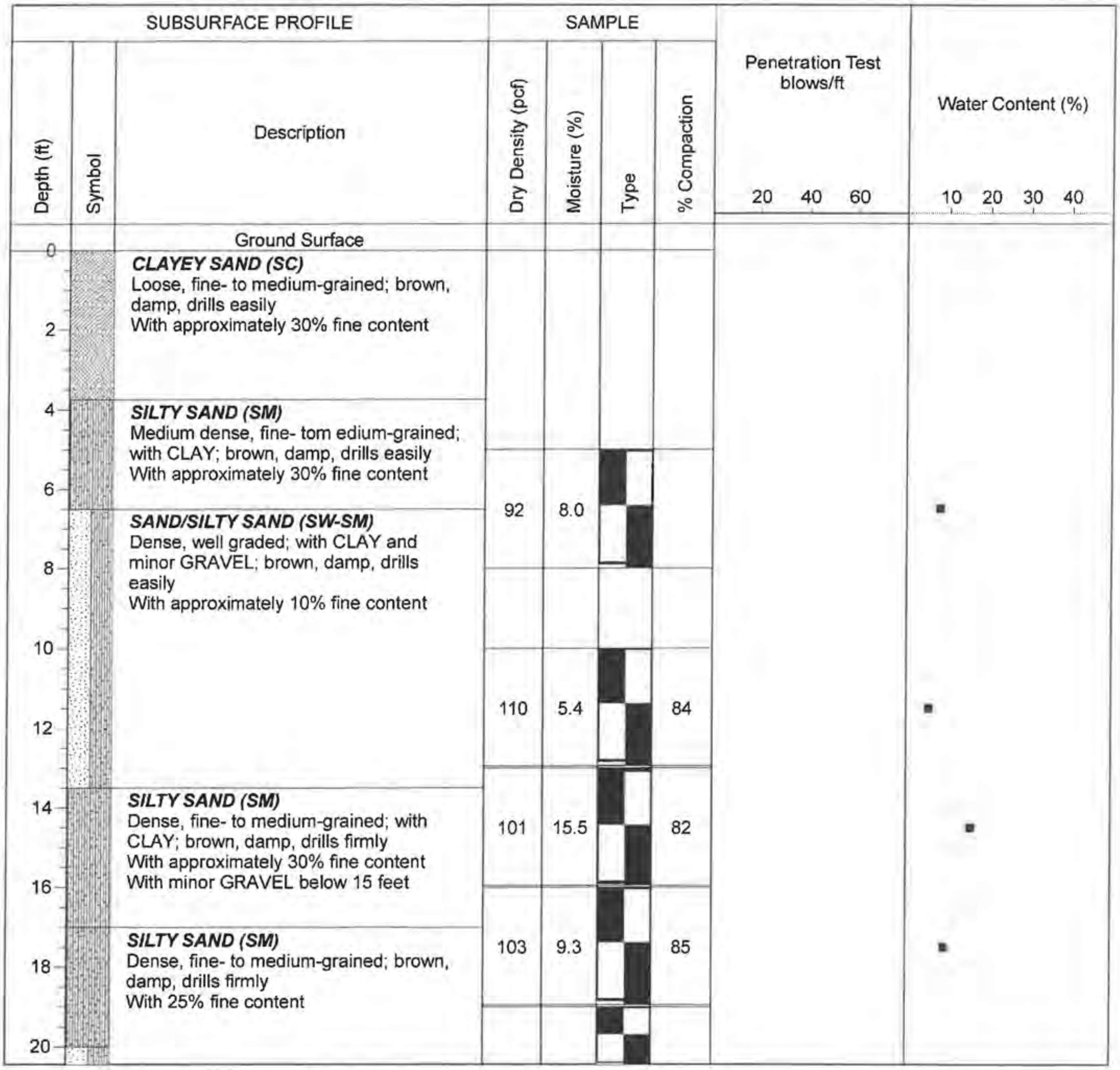
Sheet: 4 of 4

Log of Boring B16A

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-16A
Logged By: Dave Adams
At Completion: None



SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	% Compaction	Penetration Test blows/ft	Water Content (%)
0		Ground Surface						
		CLAYEY SAND (SC) Loose, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content						
		SILTY SAND (SM) Medium dense, fine- tom edium-grained; with CLAY; brown, damp, drills easily With approximately 30% fine content						
		SAND/SILTY SAND (SW-SM) Dense, well graded; with CLAY and minor GRAVEL; brown, damp, drills easily With approximately 10% fine content	92	8.0				
			110	5.4		84		
		SILTY SAND (SM) Dense, fine- to medium-grained; with CLAY; brown, damp, drills firmly With approximately 30% fine content With minor GRAVEL below 15 feet	101	15.5		82		
		SILTY SAND (SM) Dense, fine- to medium-grained; brown, damp, drills firmly With 25% fine content	103	9.3		85		

Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-9-16
Hole Size: 6 Inches
Elevation: 644 Feet
Sheet: 1 of 4

Log of Boring B16A

Project: Guzman Reservoir
Project No: 022-15055
Client: Kern Tulare Water District
Figure No.: A-16A
Location: Guzman, Kern County, CA
Logged By: Dave Adams
Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE

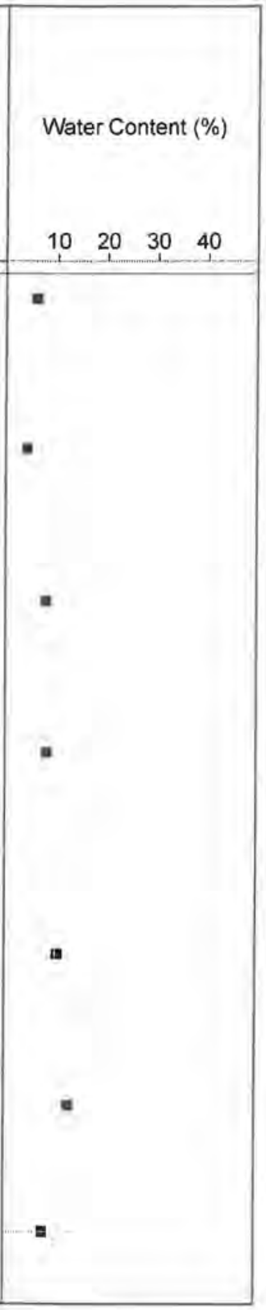
Depth (ft)	Description
	SAND/SILTY SAND (SW-SM) Dense, well graded; with minor CLAY, brown, damp, drills easily With approximately 10% fine content
22	***SANDY SILT (ML)*** Medium dense, fine- to medium-grained; with CLAY; brown, damp, drills firmly With approximately 60% fine content
24	***CLAYEY SAND (SC)*** Medium dense, well graded; brown, damp, drills easily With approximately 20% fine content
26	***SILTY SAND/CLAYEY SAND (SM/SC)*** Dense, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content
28	
30	
32	
34	***SAND/SILTY SAND (SW/SM)*** Dense, well graded; light brown, damp, drills easily With approximately 10% fine content
36	
38	
40	

SAMPLE

Dry Density (pcf)	Moisture (%)	Type	% Compaction
107	6.0		
114	4.2		
105	8.0		
112	8.2		
103	10.4		
106	12.7		
109	7.7		

Penetration Test blows/ft

20 40 60



Drill Method: Hollow Stem
Drill Date: 6-9-16
Drill Rig: CME 45C-3
Krazan and Associates
Hole Size: 6 Inches
Driller: Jim Watts
Elevation: 644 Feet
Sheet: 2 of 4

Log of Boring B17

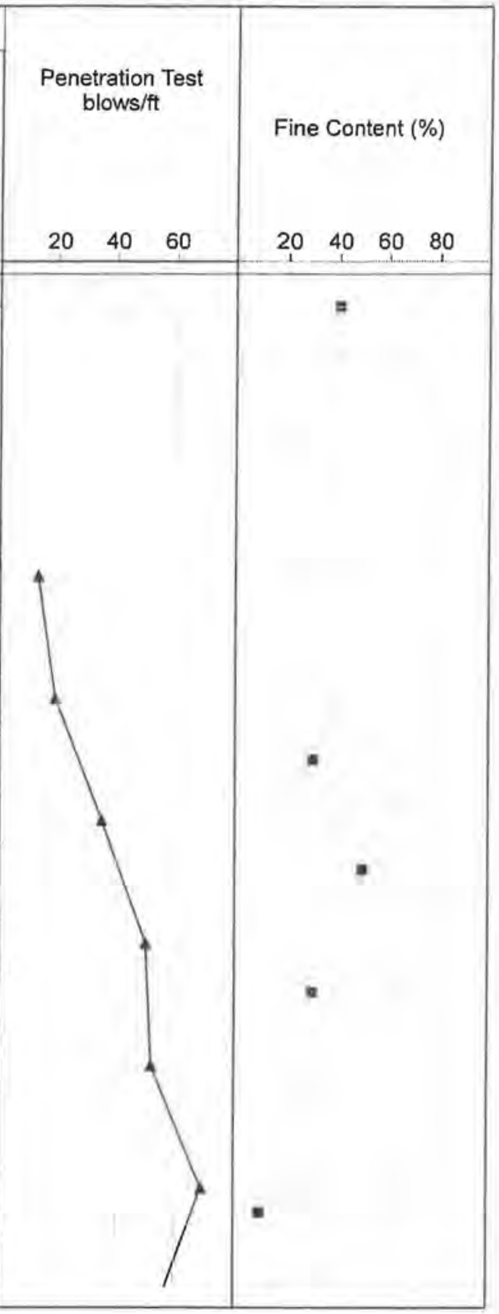
Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-17

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
0		Ground Surface				
	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; brown, damp, drills easily With approximately 40% fine content				
		Medium dense below 5 feet	29	13	◢	13
			25	12	◢	19
	▨	***CLAYEY SAND (SC)*** Dense, well graded; brown, damp, drills easily With approximately 30% fine content	26	15	◢	35
	▨	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very dense, fine- to medium-grained; brown, damp, drills tightly With approximately 50% fine content	27	10	◢	50+
	▨	***SILTY SAND (SM)*** Very dense, fine- to medium-grained; brown, damp, drills firmly With approximately 30% fine content	27	15	◢	52
			25	15	◢	69
20					◢	



Drill Method: Hollow Stem
Drill Date: 6-9-16

Drill Rig: CME 45C-3
Krazan and Associates
Hole Size: 6 Inches

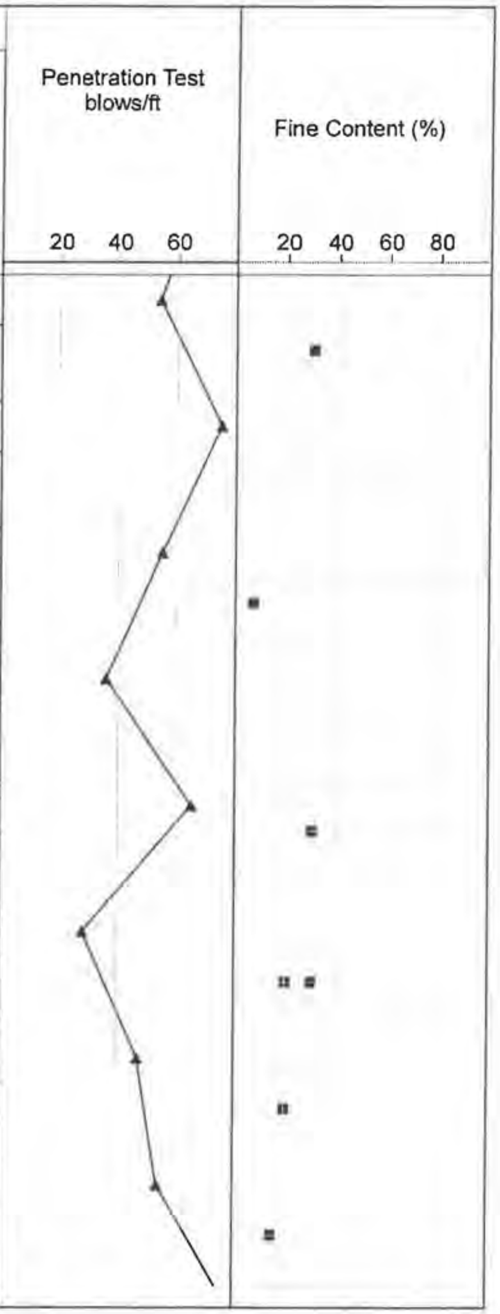
Driller: Jim Watts
Elevation: 629 Feet

Sheet: 1 of 5

Log of Boring B17

Project: Guzman Reservoir	**Project No:** 022-15055
Client: Kern Tulare Water District	**Figure No.:** A-17
Location: Guzman, Kern County, CA	**Logged By:** Dave Adams
Depth to Water> **Initial:** None	**At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
22		***SAND-SILTY SAND (SW-SM)*** Very dense, well graded; with minor GRAVEL and minor CLAY; light brown, damp, drills firmly With approximately 10% fine content	26	13	◢	54
24		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content	27	16	◢	75
26			30	14	◢	55
28		***SAND-SILTY SAND (SW-SM)*** Dense, well graded; light brown, damp, drills easily With approximately 7% fine content	28	14	◢	36
30			28	14	◢	65
32		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; with CLAY, brown, moist, drills firmly With approximately 30% fine content	28	17	◢	28
34 36		***SILTY SAND (SM)*** Dense, fine- to medium-grained; brown, damp, drills firmly With approximately 20% fine content	26	16	◢	47
38		***CLAYEY SAND (SC)*** Very dense, well graded; brown, damp, drills firmly With approximately 20% fine content	29	17	◢	54
40						



Drill Method: Hollow Stem		**Drill Date:** 6-9-16
Drill Rig: CME 45C-3	**Krazan and Associates**	**Hole Size:** 6 Inches
Driller: Jim Watts		**Elevation:** 629 Feet
		Sheet: 2 of 5

Log of Boring B17

Project: Guzman Reservoir
Project No: 022-15055

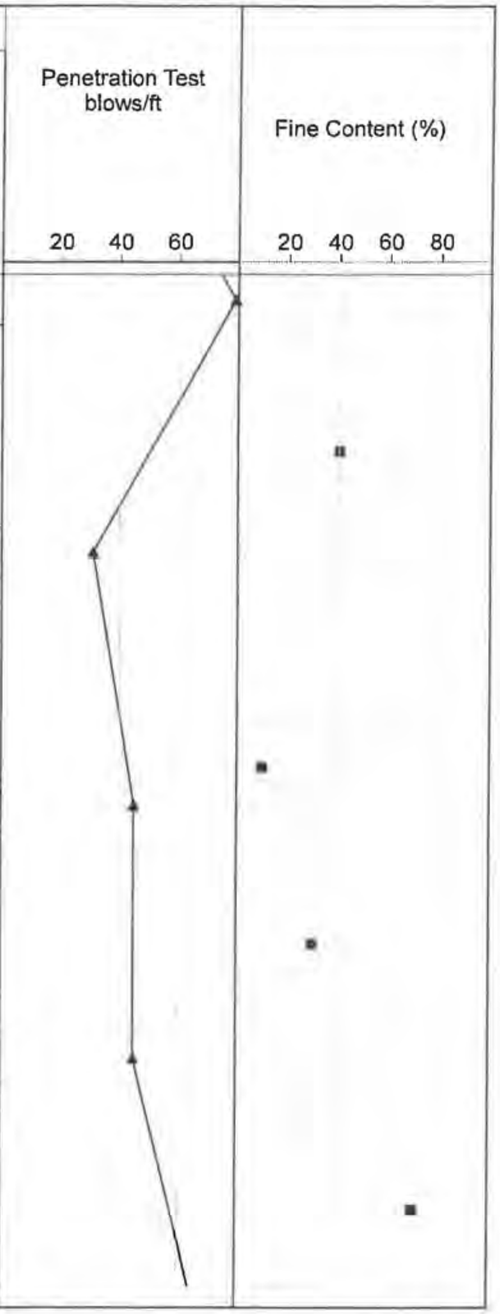
Client: Kern Tulare Water District
Figure No.: A-17

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE	SAMPLE			
Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
SILTY SAND (SM) Very dense, well graded; brown, damp, drills easily With approximately 15% fine content	26	12	◢	79
SILTY SAND (SM) Dense, fine- to medium-grained; brown, moist, drills tightly With approximately 40% fine content	25	18	◢	31
SAND/SILTY SAND (SW-SM) Dense, well graded; light brown, damp, drills firmly With approximately 10% fine content	25	12	◢	45
SILTY SAND (SM) Dense, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content	24	18	◢	45
			◢	

Depth (ft): 42, 44, 46, 48, 50, 52, 54, 56, 58, 60



Drill Method: Hollow Stem
Drill Date: 6-9-16

Drill Rig: CME 45C-3
Hole Size: 6 Inches

Krazan and Associates

Driller: Jim Watts
Elevation: 629 Feet
Sheet: 3 of 5

Log of Boring B17

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-17

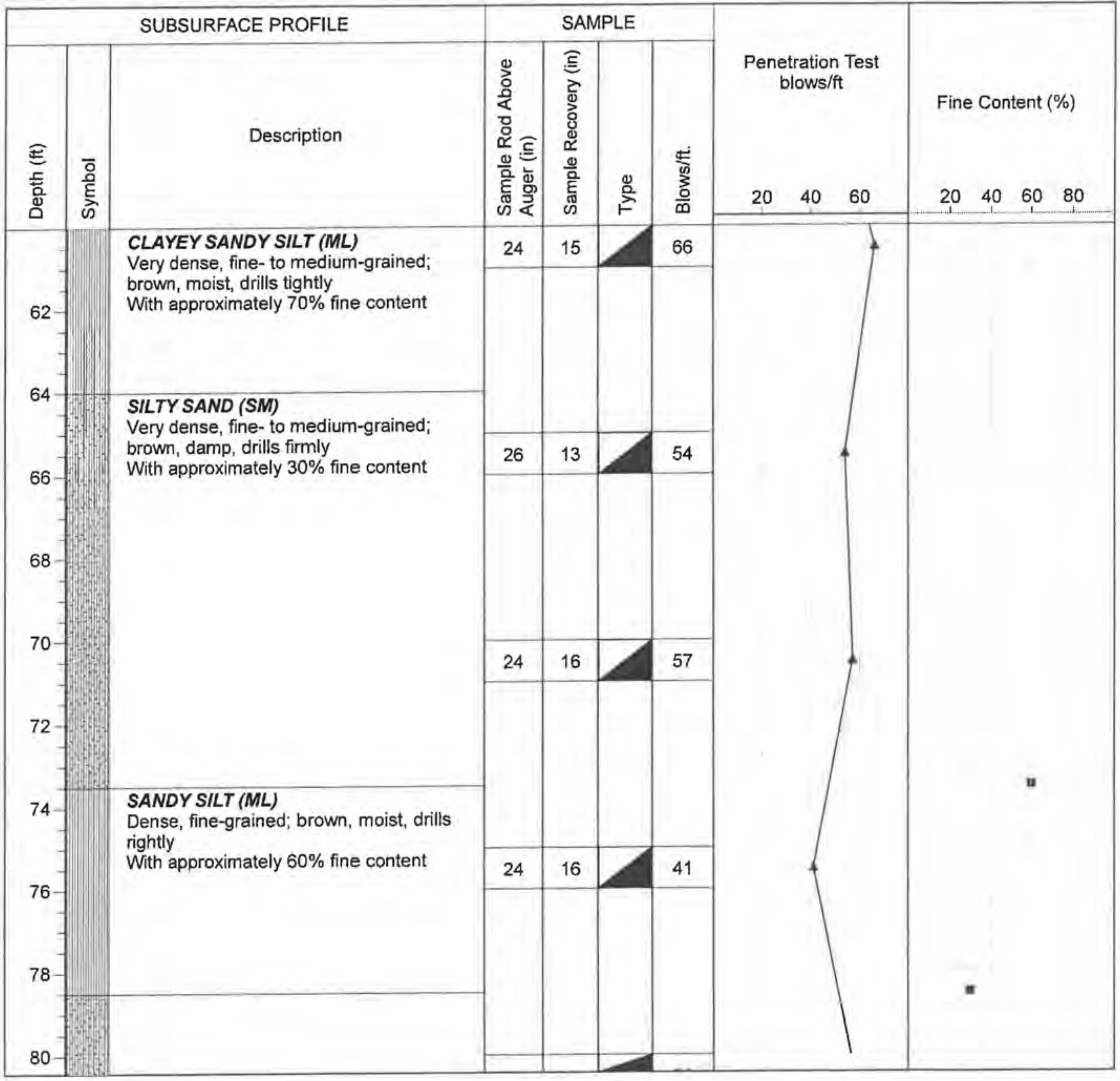
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
CLAYEY SANDY SILT (ML) Very dense, fine- to medium-grained; brown, moist, drills tightly With approximately 70% fine content	24	15	◢	66
SILTY SAND (SM) Very dense, fine- to medium-grained; brown, damp, drills firmly With approximately 30% fine content	26	13	◢	54
	24	16	◢	57
SANDY SILT (ML) Dense, fine-grained; brown, moist, drills rightly With approximately 60% fine content	24	16	◢	41

Drill Method: Hollow Stem

Drill Date: 6-9-16

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6 Inches

Driller: Jim Watts

Elevation: 629 Feet

Sheet: 4 of 5

Log of Boring B17

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

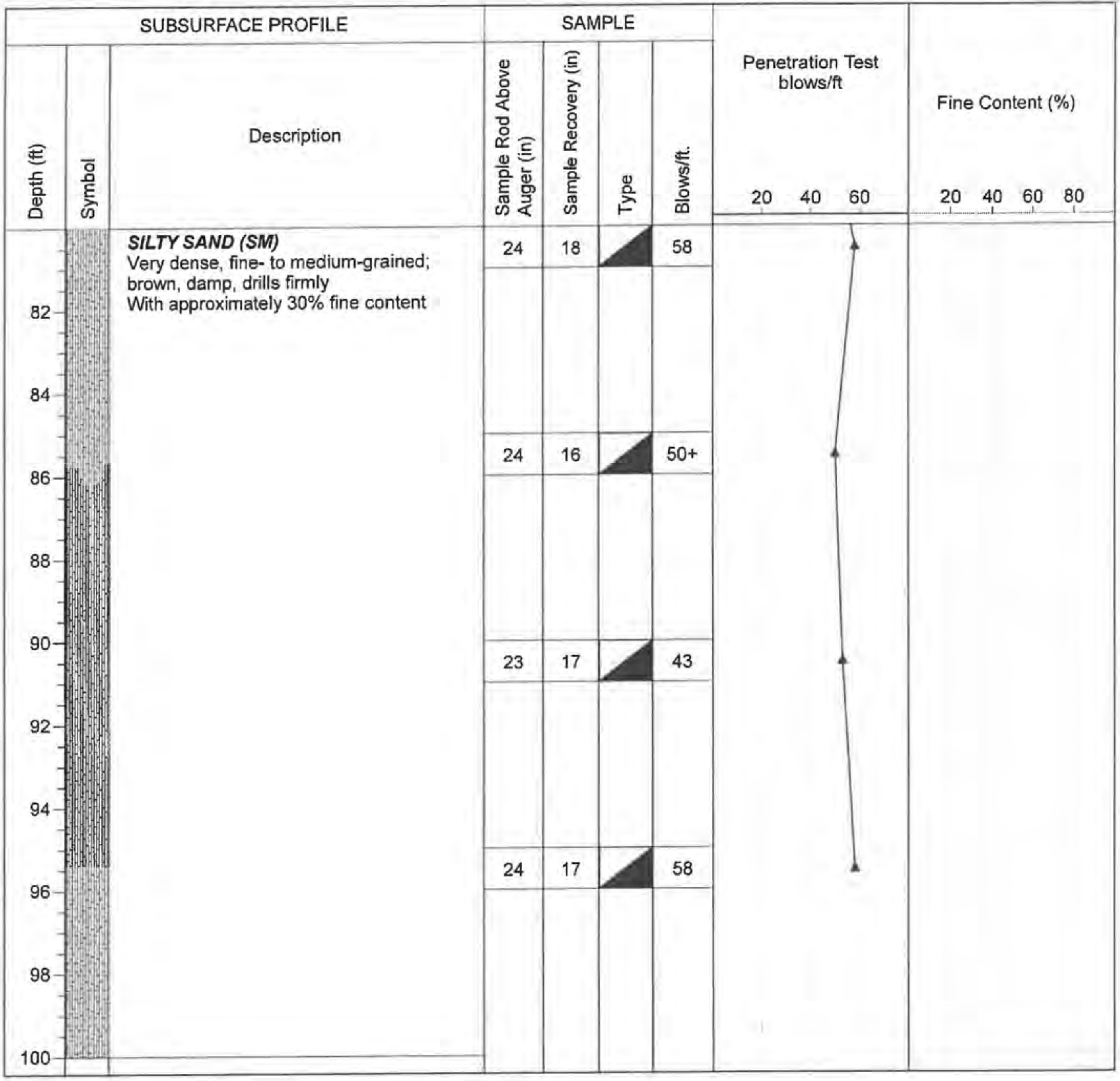
Initial: None

Project No: 022-15055

Figure No.: A-17

Logged By: Dave Adams

At Completion: None



SILTY SAND (SM)
Very dense, fine- to medium-grained; brown, damp, drills firmly
With approximately 30% fine content

Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
24	18	◢	58
24	16	◢	50+
23	17	◢	43
24	17	◢	58

Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-9-16

Hole Size: 6 Inches

Elevation: 629 Feet

Sheet: 5 of 5

Log of Boring B18

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

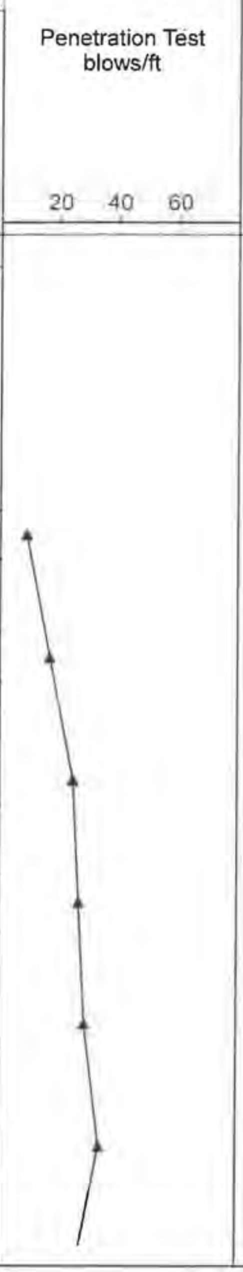
Figure No.: A-18

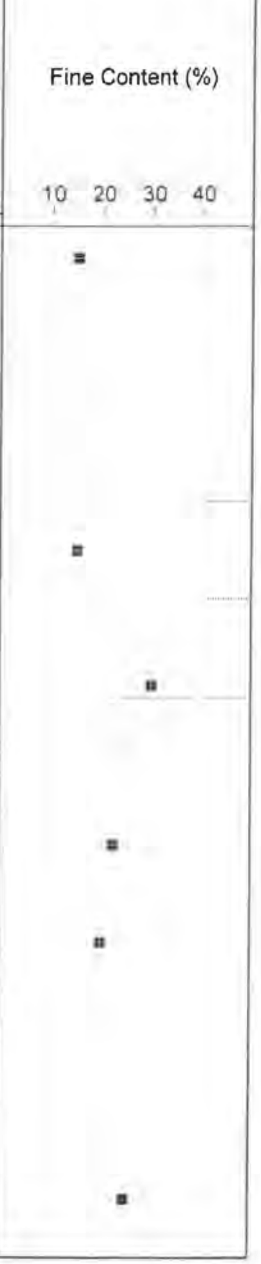
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Ro` Above Auger (in)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
2 4		***SILTY SAND (SM)*** Loose, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 30% fine content				
			28	11	◢	9
6 8		***CLAYEY SAND (SC)*** Medium dense, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content	27	14	◢	17
10		***SANDY CLAY (CL)*** Very stiff, fine- to medium-grained; brown, moist, drills easily With approximately 60% fine content	26	13	◢	25
12 14		***CLAYEY SAND/SANDY CLAY (SC-CL)*** Dense, fine- to medium-grained; brown, damp, drills easily With 40% to 50% fine content	27	12	◢	27
			27	15	◢	29
16 18		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 40% fine content	27	18	◢	34
20					◢	





Drill Method: Hollow Stem

Drill Date: 6-10-16

Drill Rig: CME 45C-3

Krazan and Associates

Hole Size: 6 Inches

Driller: Jim Watts

Elevation: 631 Feet

Sheet: 1 of 4

Log of Boring B18

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055

Figure No.: A-18

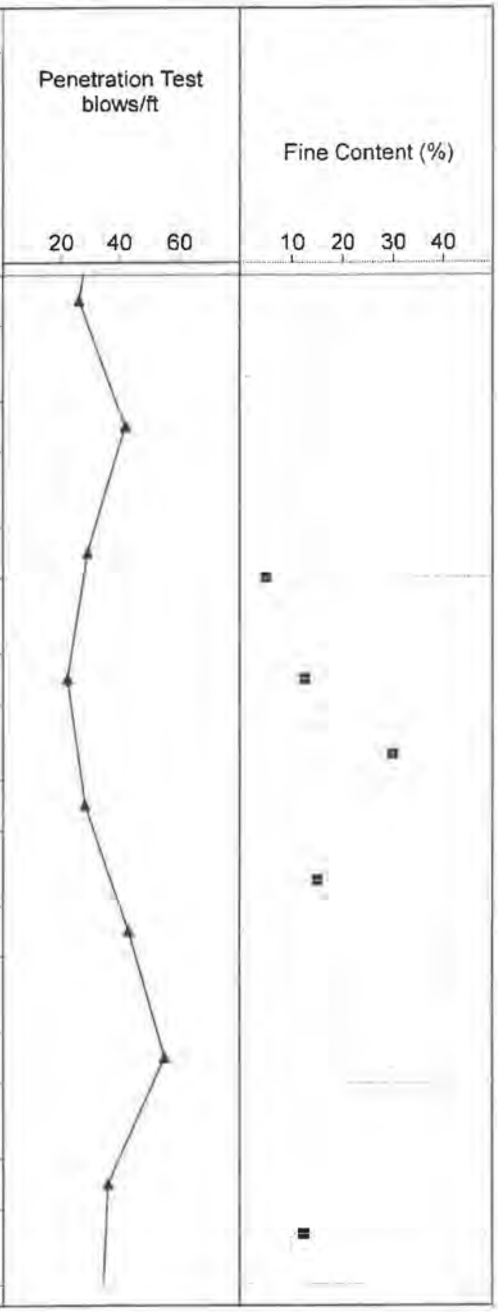
Logged By: Dave Adams

SUBSURFACE PROFILE

Depth (ft)	Description
20–22	***CLAYEY SAND/SANDY CLAY (SC/CL)*** Medium dense, fine- to medium-grained; brown, damp, drills easily With approximately 50% fine content
22–26	***SILTY SAND (SM)*** Dense, fine- to medium-grained; brown, damp, drills firmly With approximately 30% fine content Medium dense below 25 feet
26–28	***SAND/SILTY SAND (SP/SM)*** Medium dense, fine- to medium-grained; light brown, damp, drills easily With approximately 10% fine content
28–30	***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, damp, drills easily With approximately 25% fine content
30–32	***SANDY SILT (ML)*** Medium dense, fine- to medium-grained; with CLAY, brown, moist, drills firmly With approximately 60% fine content
32–39	***SILTY SAND (SM)*** Dense, fine- to medium-grained; brown, damp, drills firmly With approximately 30% fine content Very dense below 35 feet Dense below 37 feet

SAMPLE

Sample Ro`` Above Auger (in)	Moisture (%)	Type	Blows/ft.
27	16	◢	26
28	16	◢	42
25	15	◢	29
28	17	◢	22
25	15	◢	28
28	17	◢	43
26	16	◢	55
28	17	◢	36



Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-10-16

Hole Size: 6 Inches

Elevation: 631 Feet

Log of Boring B18

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None

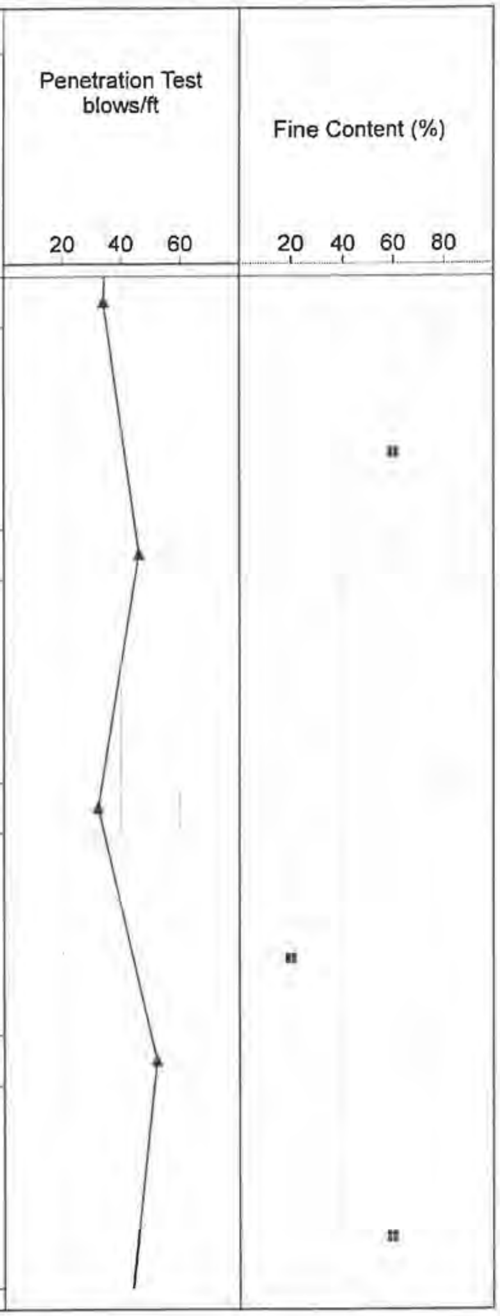
Project No: 022-15055

Figure No.: A-18

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
42	▨	***CLAYEY SAND (SC)*** Dense, well graded; orangish-brown, damp, drills very firmly With approximately 25% fine content	26	18	◢	34
44 46 48 50 52	▥	***SANDY SILT (ML)*** Dense, fine- to medium-grained; brown, damp, drills very tightly With approximately 60% fine content	25 25	17 18	◢ ◢	46 32
54 56 58	▨	***SILTY SAND (SM)*** Very dense, fine- to medium-grained; brown, damp, drills easily With approximately 20% fine content	24	17	◢	52
60	▥				◢	



Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-10-16

Hole Size: 6 Inches

Elevation: 631 Feet

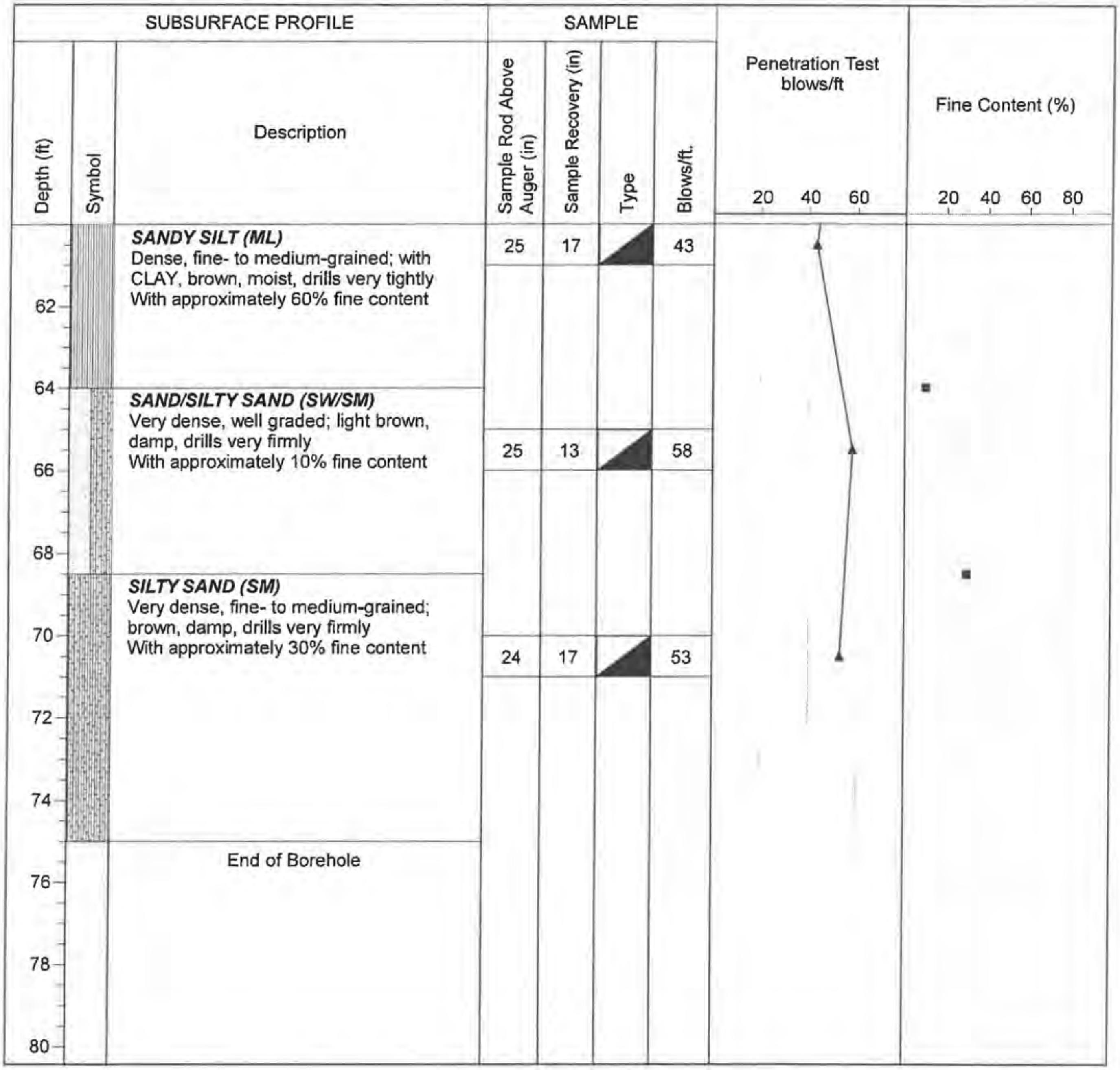
Log of Boring B18

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-18

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None



Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
SANDY SILT (ML) Dense, fine- to medium-grained; with CLAY, brown, moist, drills very tightly With approximately 60% fine content	25	17	◢	43
SAND/SILTY SAND (SW/SM) Very dense, well graded; light brown, damp, drills very firmly With approximately 10% fine content	25	13	◢	58
SILTY SAND (SM) Very dense, fine- to medium-grained; brown, damp, drills very firmly With approximately 30% fine content	24	17	◢	53
End of Borehole				

Drill Method: Hollow Stem
Drill Date: 6-10-16

Drill Rig: CME 45C-3
Krazan and Associates
Hole Size: 6 Inches

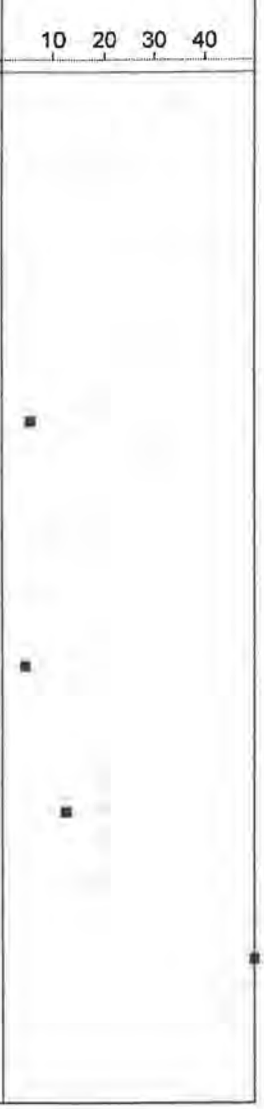
Driller: Jim Watts
Elevation: 631 Feet

Log of Boring B18A

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None

Project No: 022-15055
Figure No.: A-18A
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE				Penetration Test blows/ft	Water Content (%)
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	% Compaction	20 40 60	10 20 30 40
0		Ground Surface						
0–6		***SILTY SAND (SM)*** Loose, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 30% fine content						
6		***CLAYEY SAND (SC)*** Medium dense, fine- to medium-grained; brown, damp, drills easily With approximately 30% fine content	100	5.6				
8		***SANDY CLAY (CL)*** Very stiff, fine- to medium-grained; brown, moist, drills easily With approximately 60% fine content	102	4.5		84		
12		***CLAYEY SAND/SANDY CLAY (SC-CL)*** Dense, fine- to medium-grained; brown, damp, drills easily With 40% to 50% fine content	106	12.5		87		
16		***SILTY SAND (SM)*** Very dense, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 40% fine content	103	110.0		83		
20								



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-10-16
Hole Size: 6 Inches
Elevation: 631 Feet
Sheet: 1 of 4

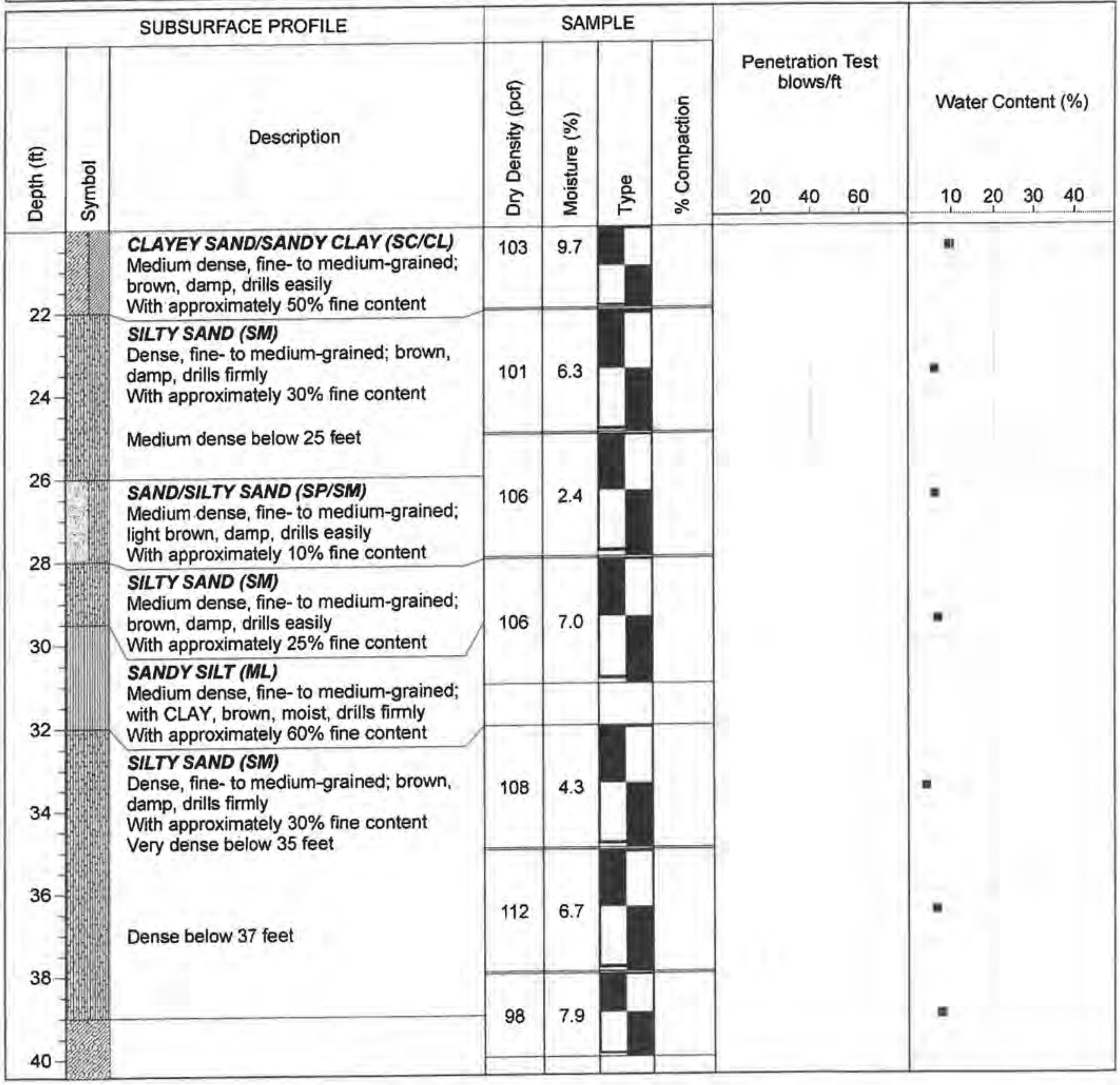
Log of Boring B18A

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-18A

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None



CLAYEY SAND/SANDY CLAY (SC/CL)
Medium dense, fine- to medium-grained; brown, damp, drills easily
With approximately 50% fine content

SILTY SAND (SM)
Dense, fine- to medium-grained; brown, damp, drills firmly
With approximately 30% fine content

Medium dense below 25 feet

SAND/SILTY SAND (SP/SM)
Medium dense, fine- to medium-grained; light brown, damp, drills easily
With approximately 10% fine content

SILTY SAND (SM)
Medium dense, fine- to medium-grained; brown, damp, drills easily
With approximately 25% fine content

SANDY SILT (ML)
Medium dense, fine- to medium-grained; with CLAY, brown, moist, drills firmly
With approximately 60% fine content

SILTY SAND (SM)
Dense, fine- to medium-grained; brown, damp, drills firmly
With approximately 30% fine content
Very dense below 35 feet

Dense below 37 feet

Dry Density (pcf)	Moisture (%)	Type	% Compaction
103	9.7		
101	6.3		
106	2.4		
106	7.0		
108	4.3		
112	6.7		
98	7.9		

Drill Method: Hollow Stem
Drill Date: 6-10-16

Drill Rig: CME 45C-3
Krazan and Associates
Hole Size: 6 Inches

Driller: Jim Watts
Elevation: 631 Feet

Sheet: 2 of 4

Log of Test Pit TP18A

Project: Guzman Reservoir

Client: Kern Tulare Water District

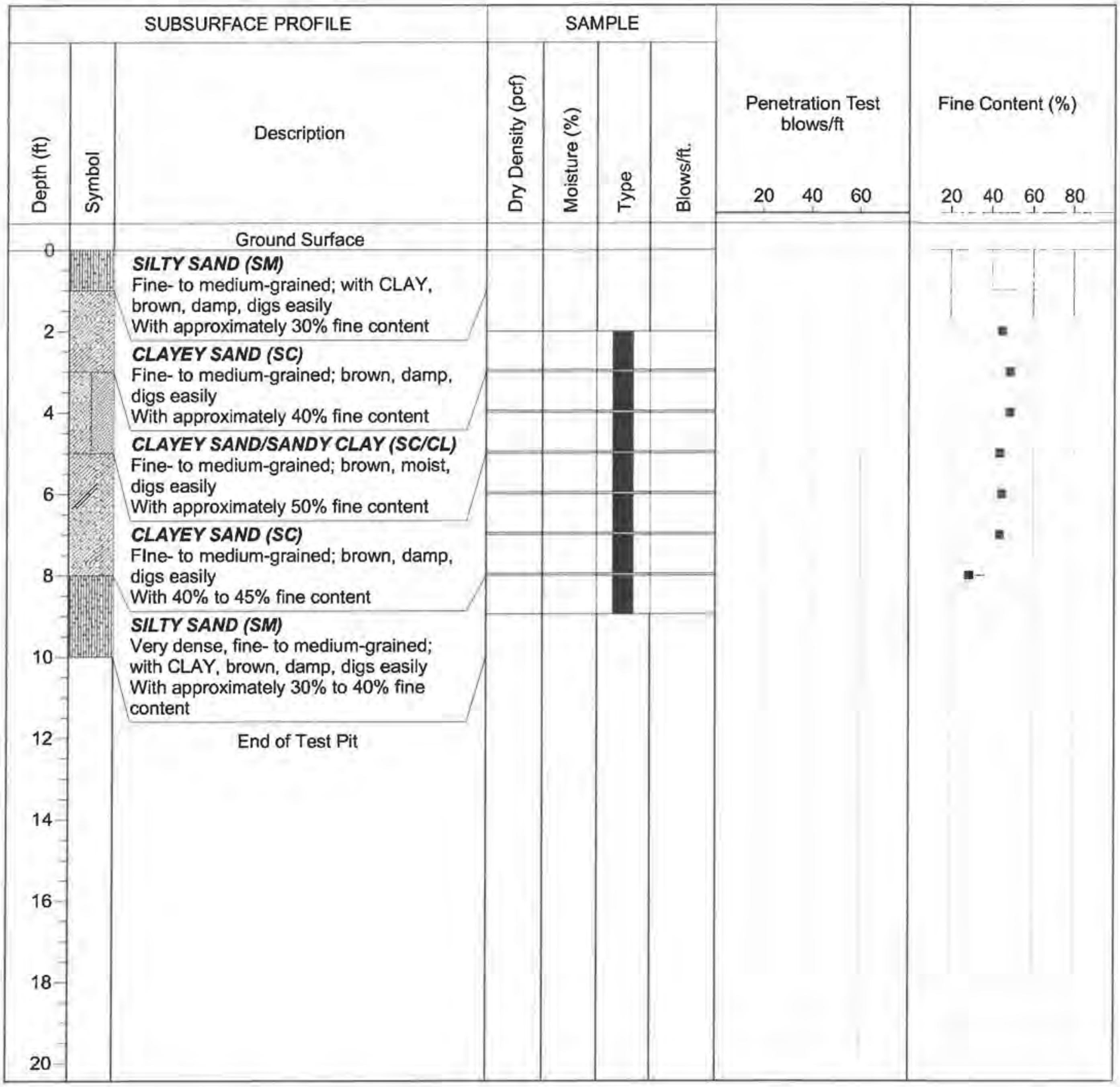
Location: Guzman, Kern County, CA

Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055

Figure No.: A-18A

Logged By: R. Alexander



Ground Surface

SILTY SAND (SM)
Fine- to medium-grained; with CLAY, brown, damp, digs easily
With approximately 30% fine content

CLAYEY SAND (SC)
Fine- to medium-grained; brown, damp, digs easily
With approximately 40% fine content

CLAYEY SAND/SANDY CLAY (SC/CL)
Fine- to medium-grained; brown, moist, digs easily
With approximately 50% fine content

CLAYEY SAND (SC)
Fine- to medium-grained; brown, damp, digs easily
With 40% to 45% fine content

SILTY SAND (SM)
Very dense, fine- to medium-grained; with CLAY, brown, damp, digs easily
With approximately 30% to 40% fine content

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 310SJ

Operator: Brent Snyder

Krazan and Associates

Excavation Date: 8-28-17

Pit Size: 24 Inches

Elevation: 631 Feet

Sheet: 1 of 1

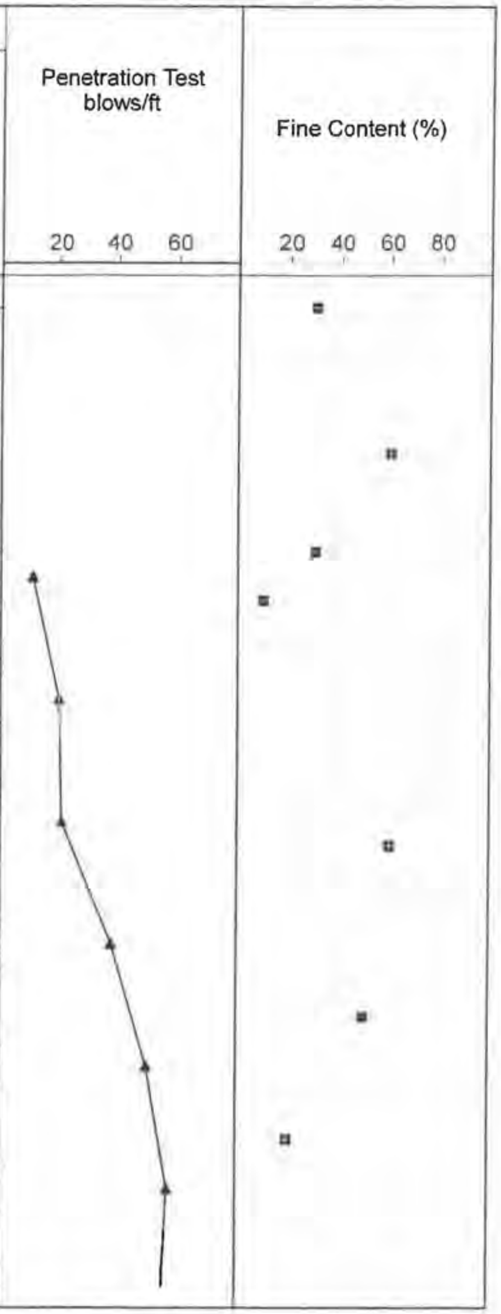
Log of Boring B19

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water>

Initial: None

Project No: 022-15055
Figure No.: A-19
Logged By: Dave Adams
At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
0		Ground Surface				
2		***SILTY SAND (SM)*** Loose, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 30% fine content				
4		***SANDY SILT (ML)*** Medium dense, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 60% fine content				
6		***CLAYEY SAND (SC)*** Medium dense, well graded; brown, damp, drills easily With approximately 30% fine content	29	12	◢	11
8		***SAND/SILTY SAND (SW-SM)*** Medium dense, well graded; light brown, very moist, drills easily With approximately 10% fine content	29	12	◢	20
10			30	12	◢	21
12 14		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, damp, drills easily With approximately 60% fine content	29	12	◢	38
16		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Very dense to hard; brown, damp, drills easily With approximately 50% fine content	27	14	◢	50
18 20		***CLAYEY SAND (SC)*** Very dense, fine- to medium-grained; brown, moist, drills tightly With approximately 20% fine content	26	12	◢	57



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

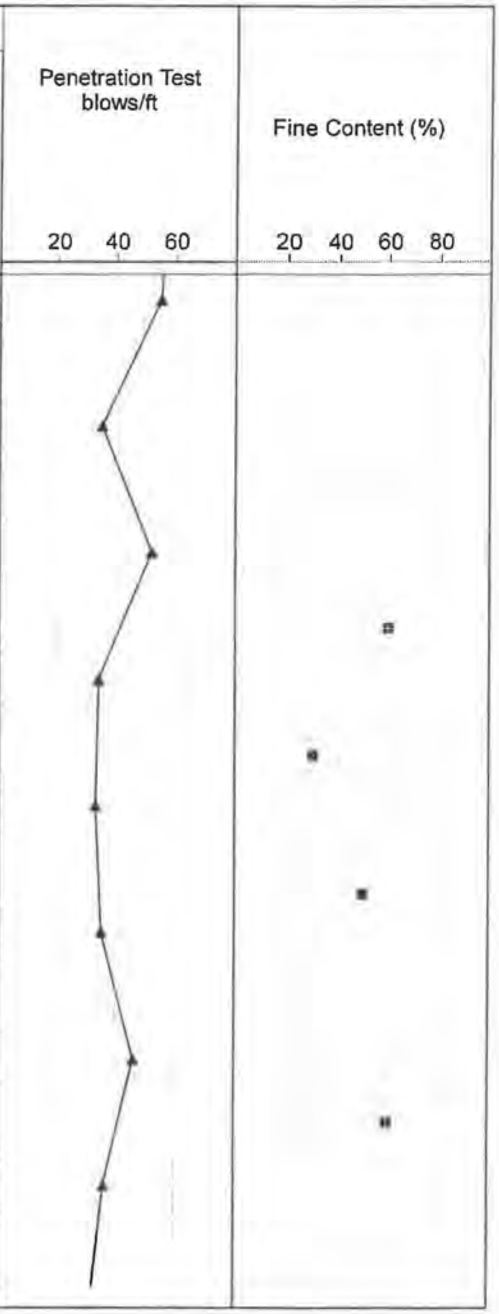
Drill Date: 6-14-16
Hole Size: 6 Inches
Elevation: 688 Feet
Sheet: 1 of 3

Log of Boring B19

Project: Guzman Reservoir
Client: Kern Tulare Water District
Location: Guzman, Kern County, CA
Depth to Water> **Initial:** None **At Completion:** None

Project No: 022-15055
Figure No.: A-19
Logged By: Dave Adams

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
			28	12	◢	55
22		Dense below 21½ feet				
			26	14	◢	35
24						
		Very dense below 25 feet	26	12	◢	52
26						
28		***SANDY SILT (ML)*** Hard, fine- to medium-grained; brown, moist, drills easily With approximately 60% fine content	29	14	◢	34
30		***SILTY SAND (SM)*** Dense, fine- to medium-grained; with CLAY, brown, moist, drills easily With approximately 30% fine content	25	13	◢	33
32						
34		***CLAYEY SAND/SANDY CLAY (SC/CL)*** Dense, fine- to medium-grained; brown, damp, drills firmly With approximately 50% fine content	28	16	◢	35
36			29	16	◢	46
38		***SANDY SILT (ML)*** Hard, fine- to medium-grained; with CLAY, brown, damp, drills easily With approximately 60% fine content	29	8	◢	36
40					◢	



Drill Method: Hollow Stem
Drill Rig: CME 45C-3
Driller: Jim Watts

Krazan and Associates

Drill Date: 6-14-16
Hole Size: 6 Inches
Elevation: 688 Feet
Sheet: 2 of 3

Log of Boring B19

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

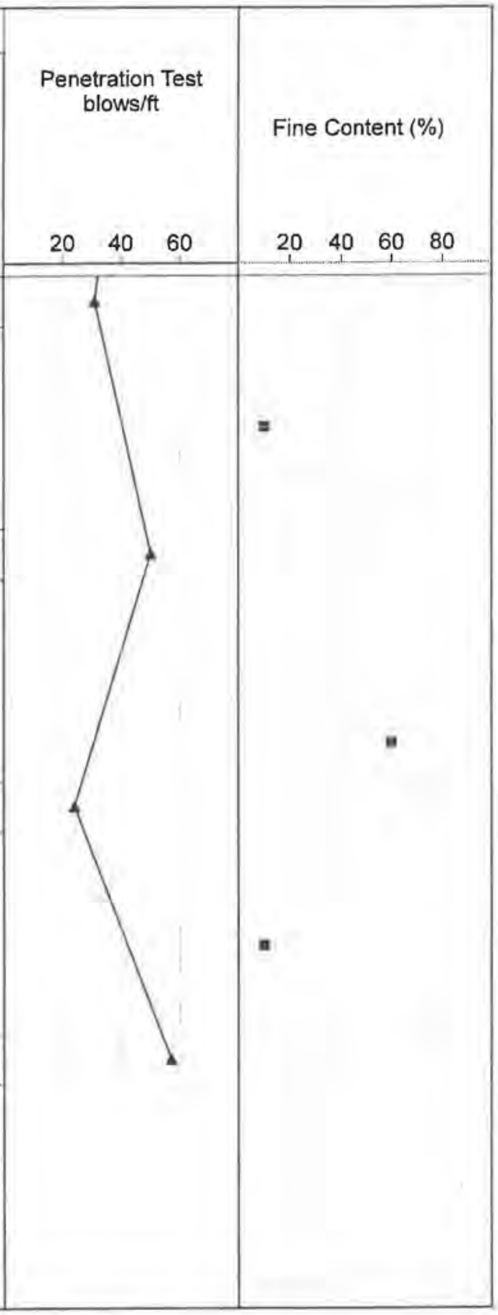
Project No: 022-15055

Figure No.: A-19

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE			
Depth (ft)	Symbol	Description	Sample Rod Above Auger (in)	Sample Recovery (in)	Type	Blows/ft.
			28	14	◣	31
		SAND/SILTY SAND (SW-SM) Dense to very dense, well graded; light brown, damp, drills easily With approximately 10% fine content	26	12	◣	50
		SANDY SILT (ML) Hard, fine- to medium-grained; with CLAY, brown, moist, drills easily With approximately 60% fine content	30	12	◣	24
		SAND/SILTY SAND (SW-SM) Very dense, well graded; light brown, damp, drills easily With approximately 10% fine content	28	13	◣	57



Drill Method: Hollow Stem

Drill Rig: CME 45C-3

Driller: Jim Watts

Krazan and Associates

Drill Date: 6-14-16

Hole Size: 6 Inches

Elevation: 688 Feet

Log of Test Pit TP1

Project: Guzman Reservoir

Project No: 022-15055

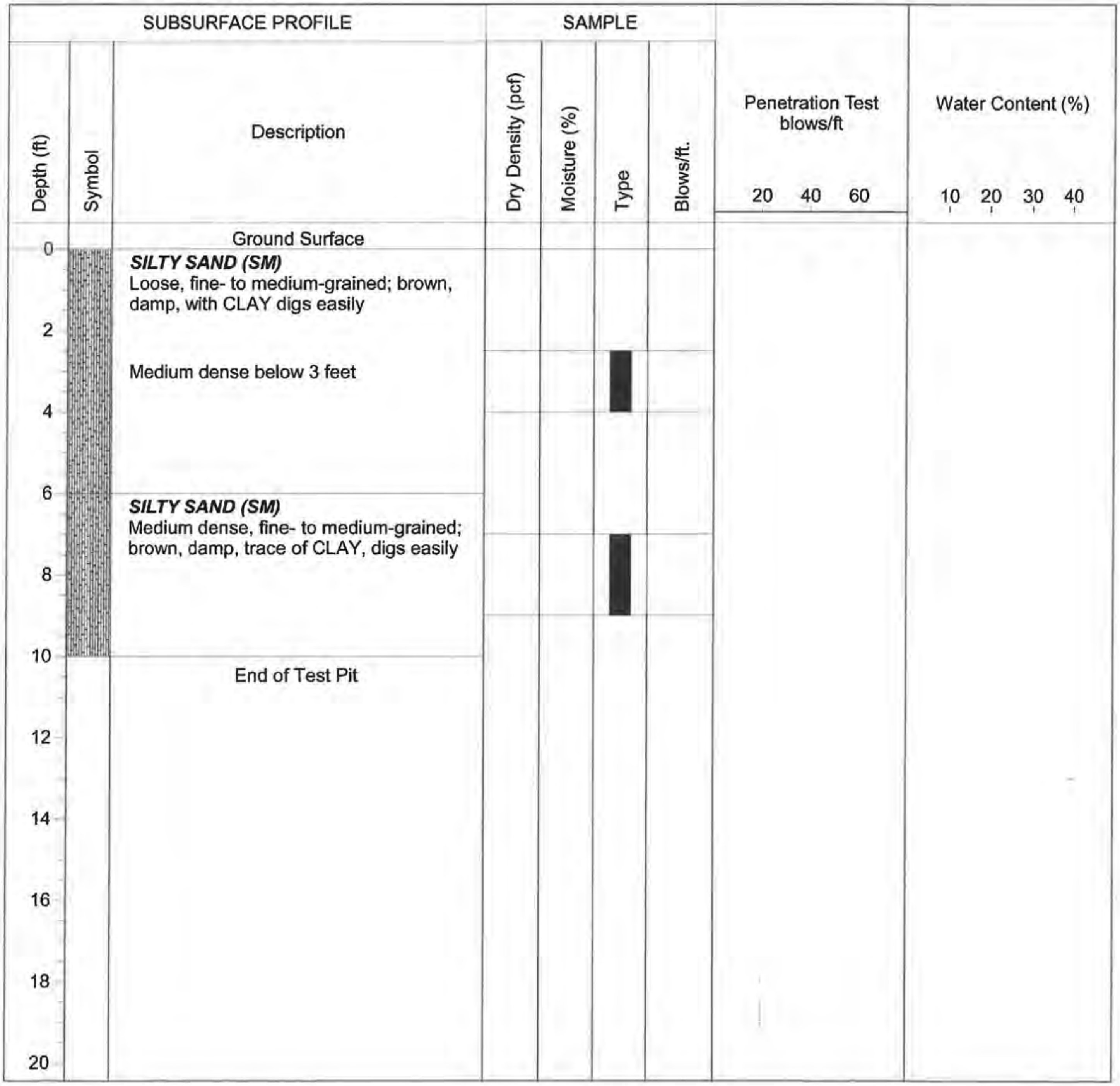
Client: Kern Tulare Water District

Figure No.: A-13

Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None



Ground Surface

SILTY SAND (SM)
Loose, fine- to medium-grained; brown, damp, with CLAY digs easily

Medium dense below 3 feet

SILTY SAND (SM)
Medium dense, fine- to medium-grained; brown, damp, trace of CLAY, digs easily

End of Test Pit

Method: Backhoe

Excavation Date: 8-10-15

Backhoe/Excavator: Deere 410K

Krazan and Associates

Pit Size: 18 Inches

Operator: Jim Watts

Elevation: 655 Feet

Sheet: 1 of 1

Log of Test Pit TP2

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-14

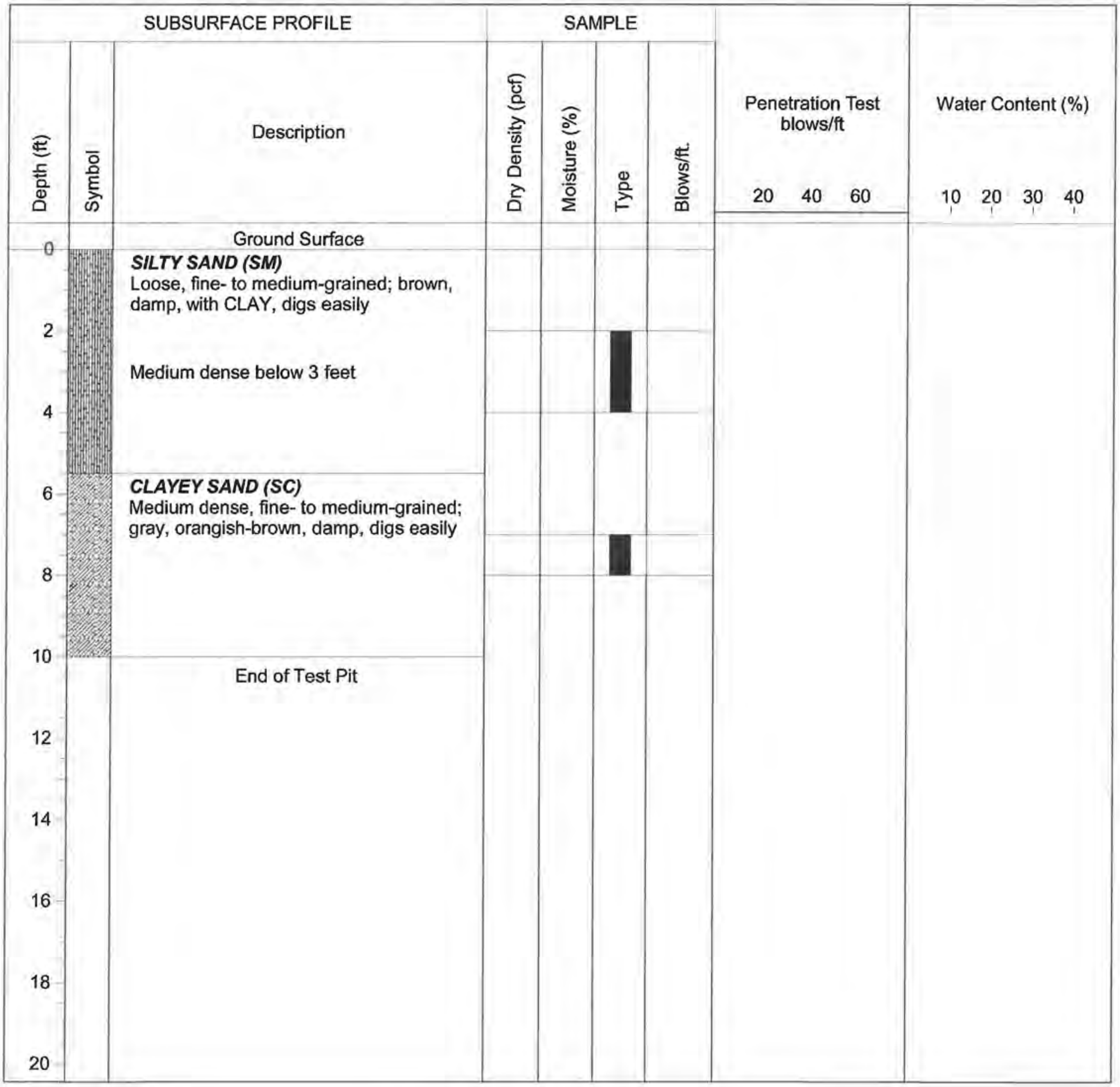
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



SILTY SAND (SM)
Loose, fine- to medium-grained; brown, damp, with CLAY, digs easily

Medium dense below 3 feet

CLAYEY SAND (SC)
Medium dense, fine- to medium-grained; gray, orangish-brown, damp, digs easily

Method: Backhoe

Excavation Date: 8-10-15

Backhoe/Excavator: Deere 410K

Krazan and Associates

Pit Size: 18 Inches

Operator: Jim Watts

Elevation: 648 Feet

Sheet: 1 of 1

Log of Test Pit TP3

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-15

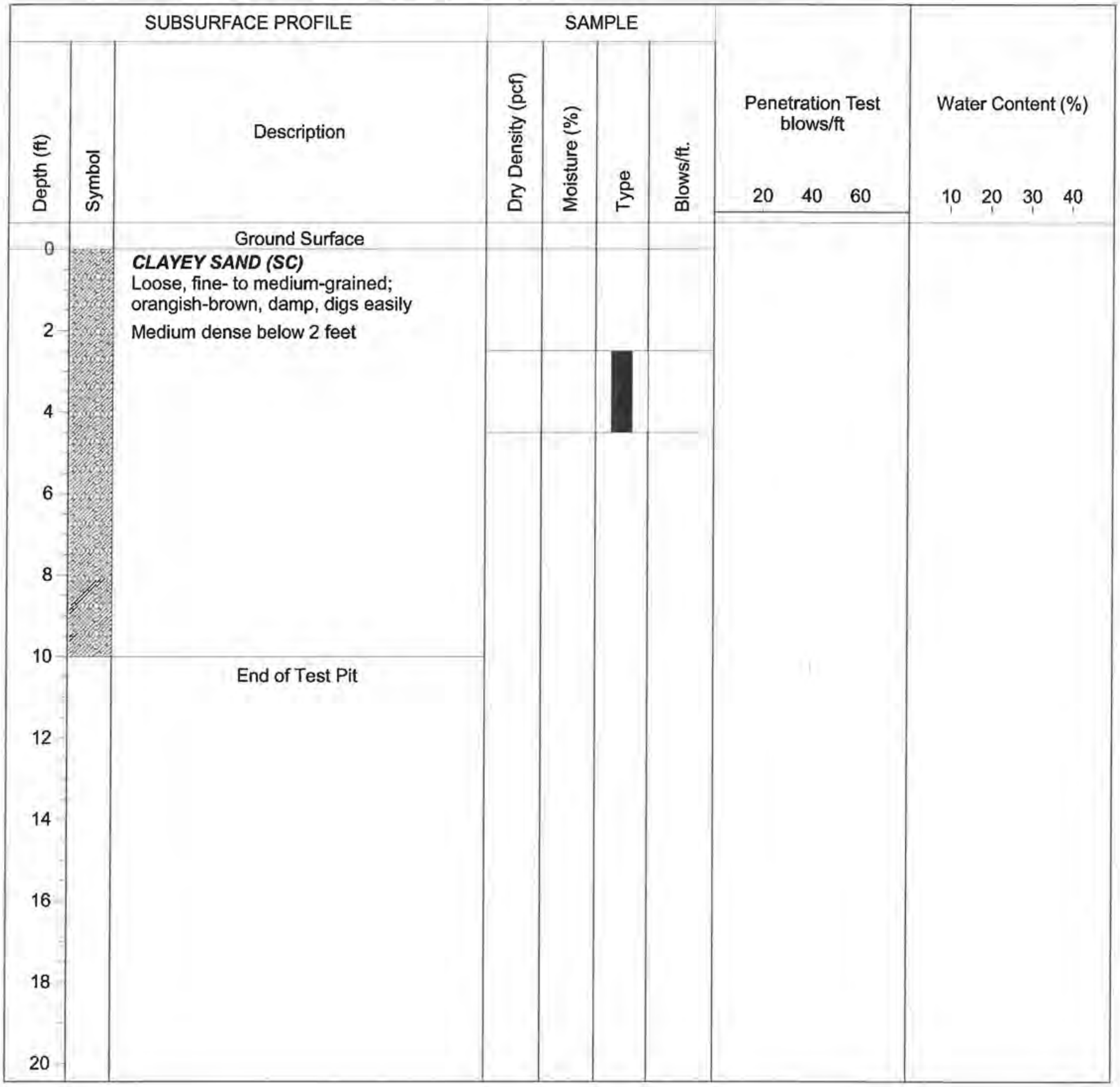
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



Ground Surface

CLAYEY SAND (SC)
Loose, fine- to medium-grained; orangish-brown, damp, digs easily

Medium dense below 2 feet

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-10-15

Pit Size: 18 Inches

Elevation: 642 Feet

Sheet: 1 of 1

Log of Test Pit TP4

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Project No: 022-15055

Figure No.: A-16

Logged By: Dave Adams

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; orangish-brown, damp, digs easily						
2	▨	Medium dense and digs firmly below 2½ feet			■			
4	▨							
6	▨							
8	▥	***SANDY SILT (ML)*** Dense, fine- to medium-grained; brown, moist, with CLAY, digs easily			■			
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-10-15

Pit Size: 18 Inches

Elevation: 639 Feet

Sheet: 1 of 1

Log of Test Pit TP5

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

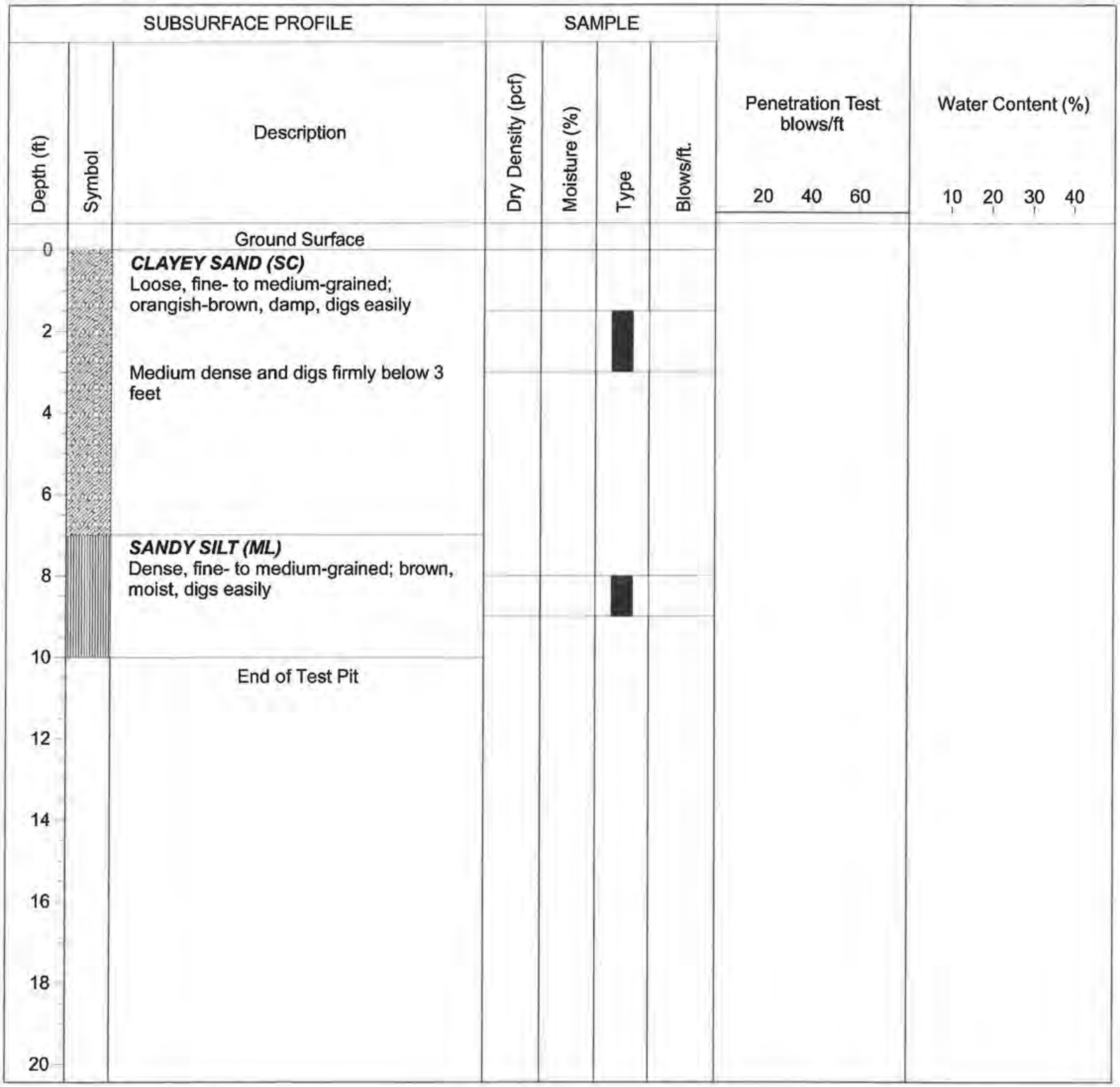
Initial: None

Project No: 022-15055

Figure No.: A-17

Logged By: Dave Adams

At Completion: None



Ground Surface

CLAYEY SAND (SC)
Loose, fine- to medium-grained; orangish-brown, damp, digs easily

Medium dense and digs firmly below 3 feet

SANDY SILT (ML)
Dense, fine- to medium-grained; brown, moist, digs easily

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-10-15

Pit Size: 18 Inches

Elevation: 660 Feet

Sheet: 1 of 1

Log of Test Pit TP6

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-18

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; orangish-brown, damp, digs easily						
2	▨	Medium dense and digs firmly below 2 feet			■			
4	▨							
6	▨							
8	▨	With increased SAND below 8 feet						
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe
Excavation Date: 8-10-15

Backhoe/Excavator: Deere 410K
Pit Size: 18 Inches

Krazan and Associates

Operator: Jim Watts
Elevation: 650 Feet

Sheet: 1 of 1

Log of Test Pit TP7

Project: Guzman Reservoir

Project No: 022-15055

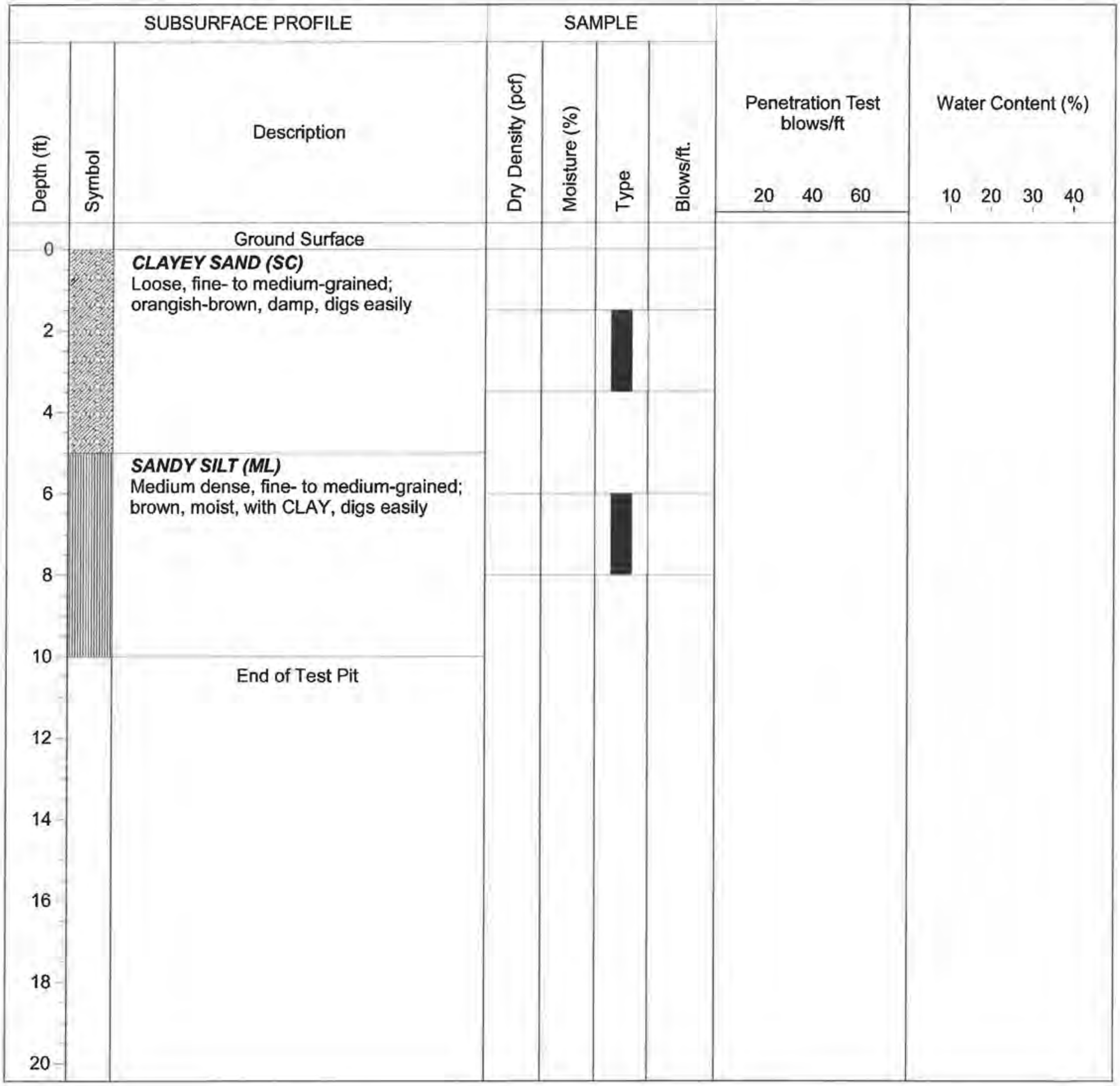
Client: Kern Tulare Water District

Figure No.: A-19

Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water> **Initial:** None **At Completion:** None



Ground Surface

CLAYEY SAND (SC)
Loose, fine- to medium-grained; orangish-brown, damp, digs easily

SANDY SILT (ML)
Medium dense, fine- to medium-grained; brown, moist, with CLAY, digs easily

End of Test Pit

Method: Backhoe

Excavation Date: 8-10-15

Backhoe/Excavator: Deere 410K

Krazan and Associates

Pit Size: 18 Inches

Operator: Jim Watts

Elevation: 645 Feet

Sheet: 1 of 1

Log of Test Pit TP8

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

Initial: None

Project No: 022-15055

Figure No.: A-20

Logged By: Dave Adams

At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▨	***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, digs easily						
2	▨				■			
4	▨	***CLAYEY SAND (SC)*** Medium dense, fine- to coarse-grained; orangish-brown, damp, digs easily			■			
6	▨							
8	▨							
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-10-15

Pit Size: 18 Inches

Elevation: 644 Feet

Sheet: 1 of 1

Log of Test Pit TP9

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-21

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; reddish-brown, damp, digs easily						
2	▨	Medium dense and digs firmly below 2½ feet			■			
4	▨							
6	▨							
8	▨							
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe
Excavation Date: 8-10-15

Backhoe/Excavator: Deere 410K
Krazan and Associates
Pit Size: 18 Inches

Operator: Jim Watts
Elevation: 649 Feet

Sheet: 1 of 1

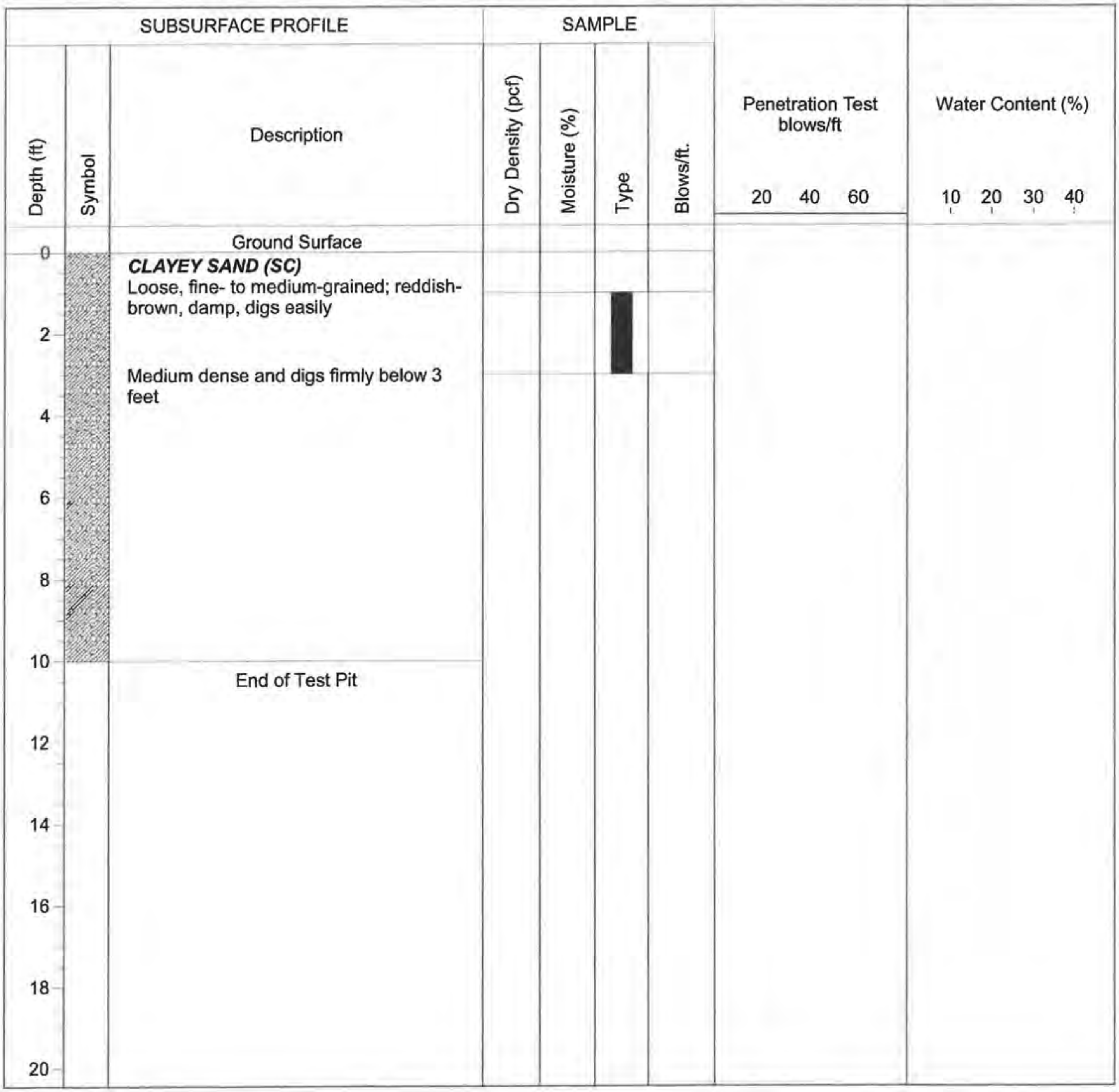
Log of Test Pit TP10

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-22

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None



Ground Surface

CLAYEY SAND (SC)
Loose, fine- to medium-grained; reddish-brown, damp, digs easily

Medium dense and digs firmly below 3 feet

End of Test Pit

Method: Backhoe
Excavation Date: 8-10-15

Backhoe/Excavator: Deere 410K

Krazan and Associates

Pit Size: 18 Inches

Operator: Jim Watts
Elevation: 655 Feet

Sheet: 1 of 1

Log of Test Pit TP11

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-23

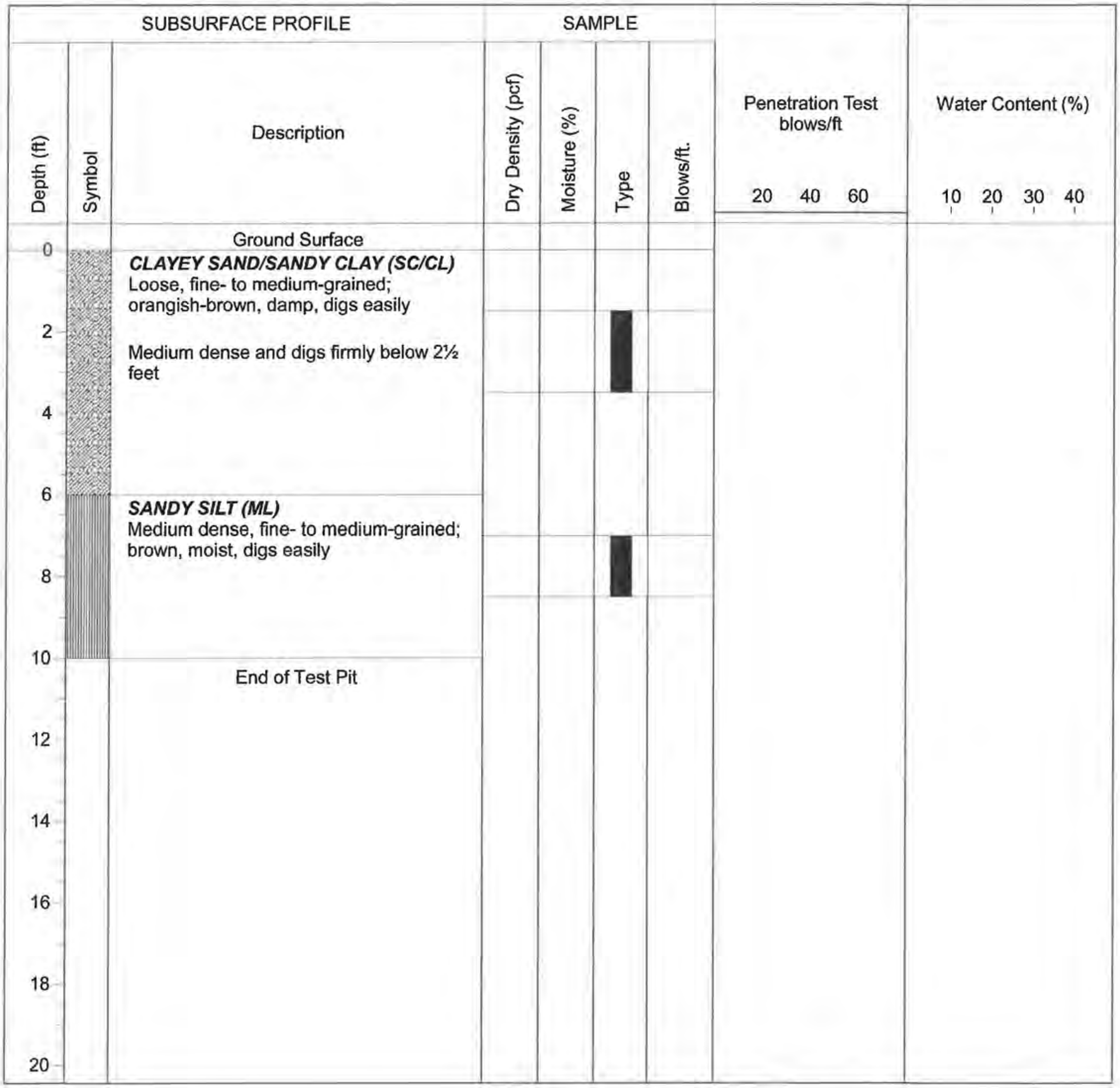
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



Ground Surface

CLAYEY SAND/SANDY CLAY (SC/CL)
Loose, fine- to medium-grained; orangish-brown, damp, digs easily

Medium dense and digs firmly below 2½ feet

SANDY SILT (ML)
Medium dense, fine- to medium-grained; brown, moist, digs easily

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-10-15

Pit Size: 18 Inches

Elevation: 662 Feet

Sheet: 1 of 1

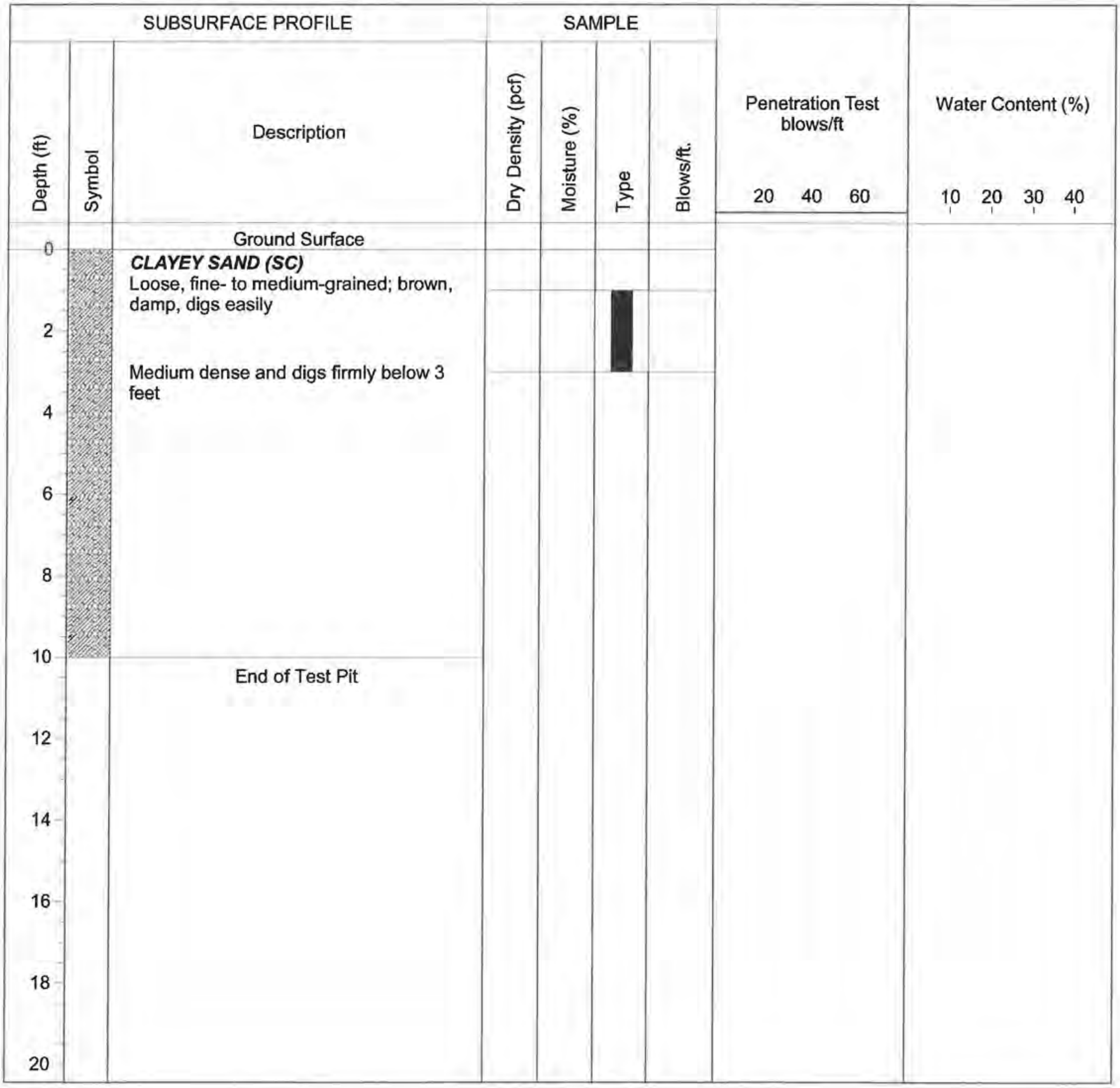
Log of Test Pit TP12

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-24

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None



Ground Surface

CLAYEY SAND (SC)
Loose, fine- to medium-grained; brown, damp, digs easily

Medium dense and digs firmly below 3 feet

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-11-15

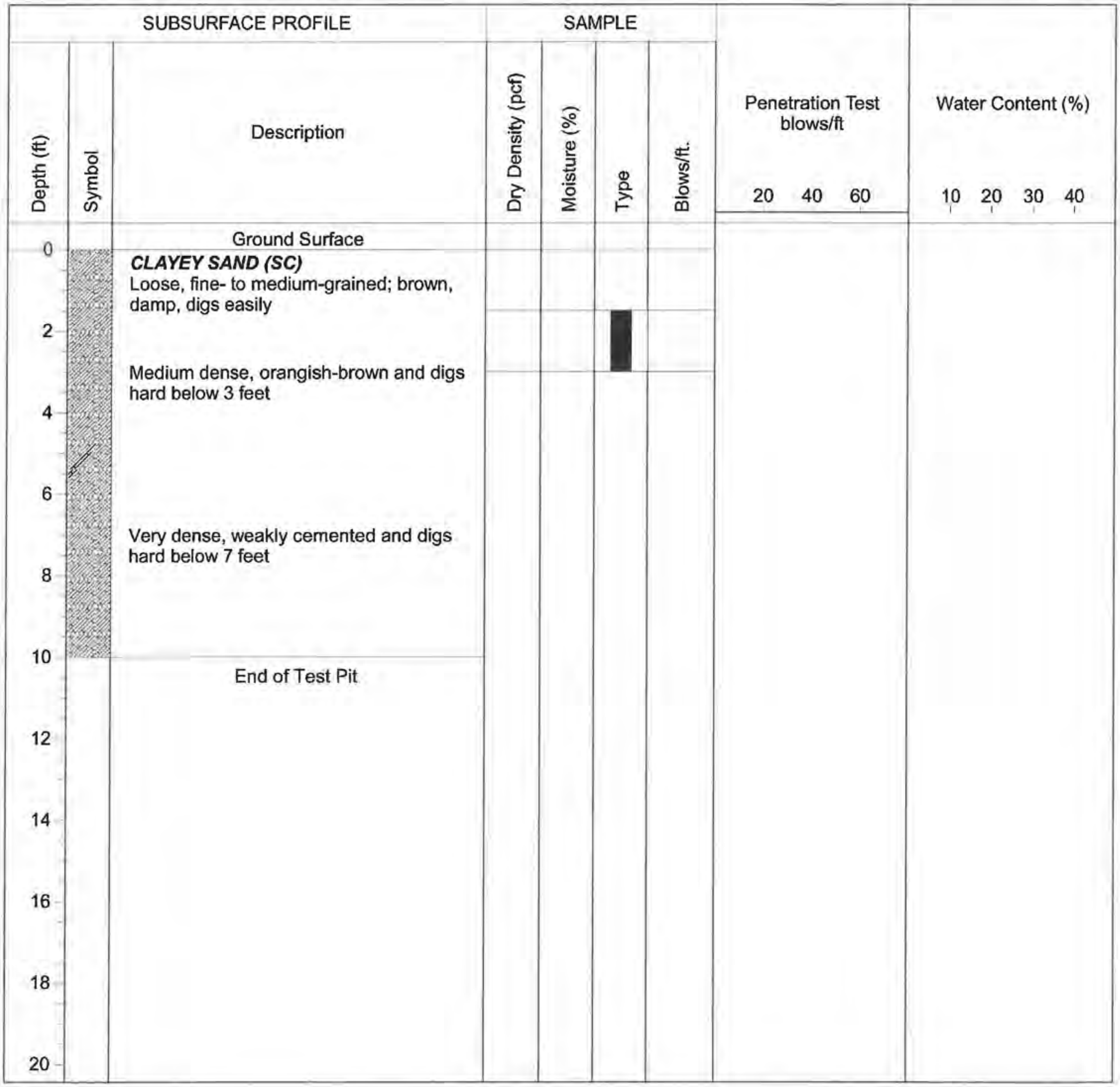
Pit Size: 18 Inches

Elevation: 690 Feet

Sheet: 1 of 1

Log of Test Pit TP13

Project: Guzman Reservoir
Project No: 022-15055
Client: Kern Tulare Water District
Figure No.: A-25
Location: Guzman, Kern County, CA
Logged By: Dave Adams
Depth to Water>
Initial: None
At Completion: None



Ground Surface

CLAYEY SAND (SC)
Loose, fine- to medium-grained; brown, damp, digs easily

Medium dense, orangish-brown and digs hard below 3 feet

Very dense, weakly cemented and digs hard below 7 feet

End of Test Pit

Method: Backhoe
Excavation Date: 8-11-15
Backhoe/Excavator: Deere 410K
Krazan and Associates
Pit Size: 18 Inches
Operator: Jim Watts
Elevation: 679 Feet
Sheet: 1 of 1

Log of Test Pit TP14

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-26

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▨	***CLAYEY SAND (SC)*** Loose, fine- to medium-grained; brown, damp, digs easily						
2	▨				■			
4	▨							
6	▨							
8	▨	Medium dense and digs firmly below 8 feet						
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe
Excavation Date: 8-11-15

Backhoe/Excavator: Deere 410K
Krazan and Associates
Pit Size: 18 Inches

Operator: Jim Watts
Elevation: 656 Feet

Sheet: 1 of 1

Log of Test Pit TP15

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-27

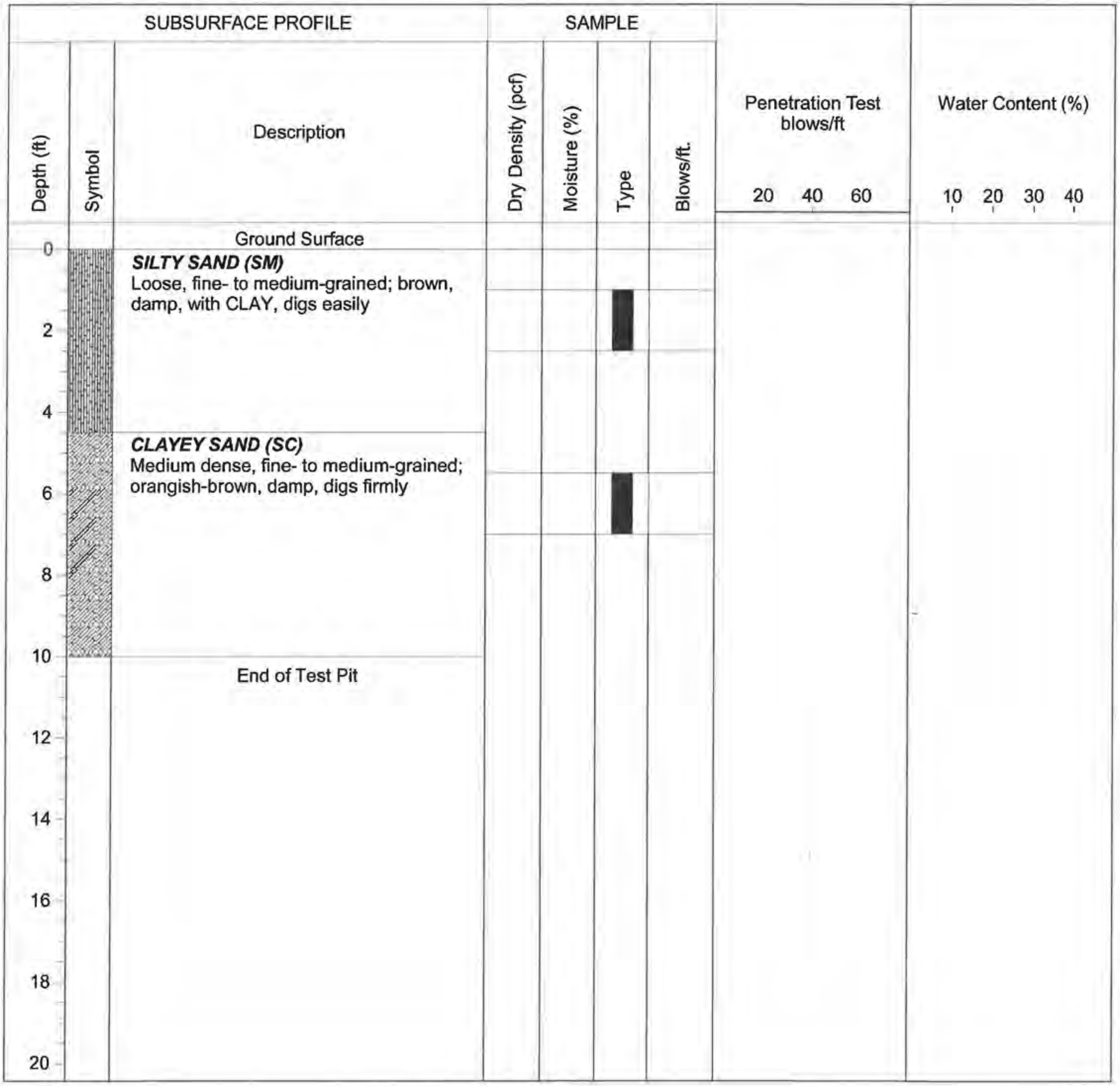
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



Ground Surface

SILTY SAND (SM)
Loose, fine- to medium-grained; brown, damp, with CLAY, digs easily

CLAYEY SAND (SC)
Medium dense, fine- to medium-grained; orangish-brown, damp, digs firmly

End of Test Pit

Method: Backhoe

Excavation Date: 8-11-15

Backhoe/Excavator: Deere 410K

Krazan and Associates

Pit Size: 18 Inches

Operator: Jim Watts

Elevation: 650 Feet

Sheet: 1 of 1

Log of Test Pit TP16

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-28

Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▥	***SILTY SAND (SM)*** Loose, fine- to medium-grained; brown, damp, with CLAY, digs easily						
2	▥				■			
4	▨	***CLAYEY SAND (SC)*** Medium dense, fine- to medium-grained; brown, damp, digs firmly						
6	▨				■			
8	▨							
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-11-15

Pit Size: 18 Inches

Elevation: 646 Feet

Sheet: 1 of 1

Log of Test Pit TP17

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-29

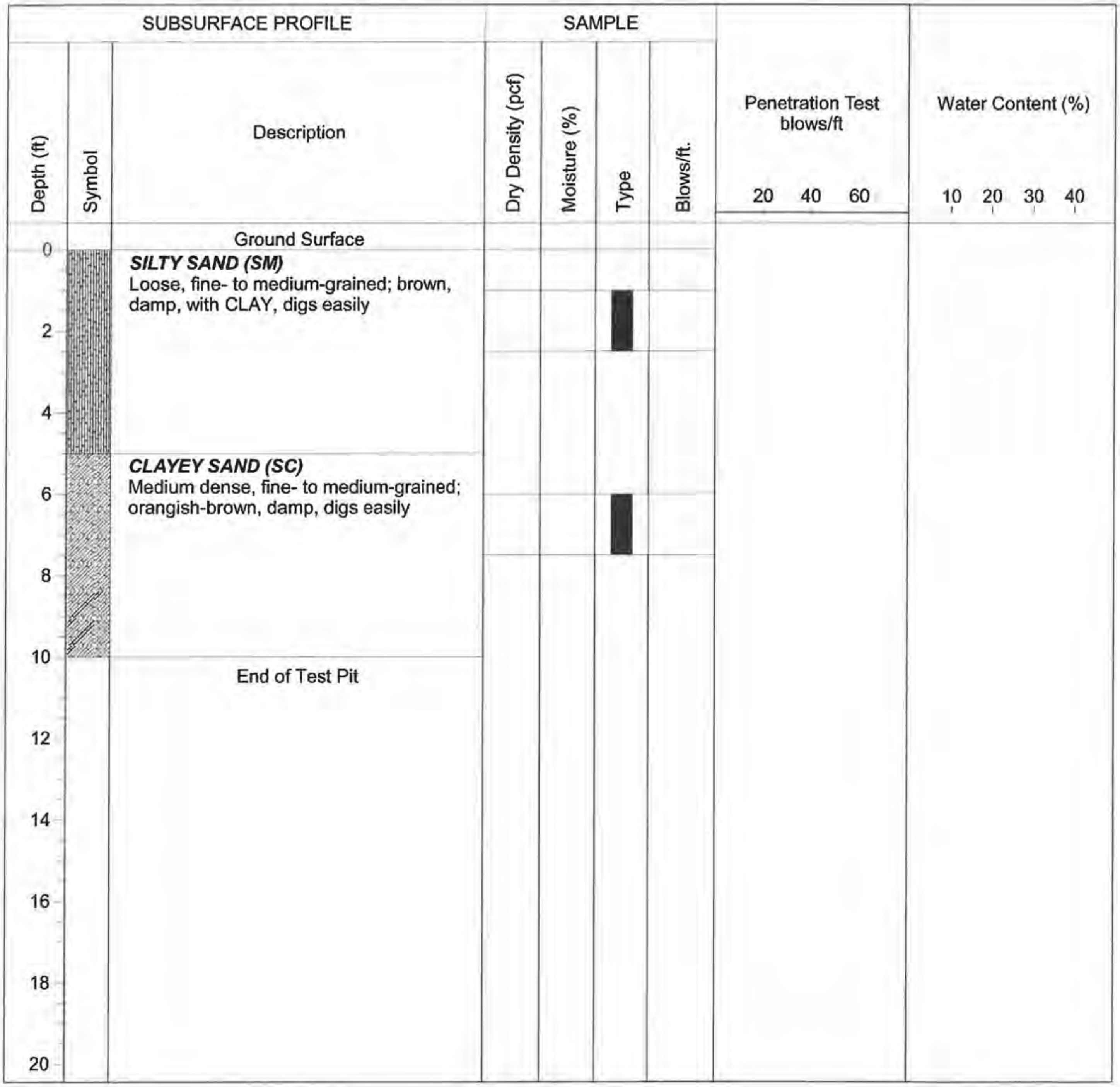
Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



Ground Surface

SILTY SAND (SM)
Loose, fine- to medium-grained; brown, damp, with CLAY, digs easily

CLAYEY SAND (SC)
Medium dense, fine- to medium-grained; orangish-brown, damp, digs easily

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-11-15

Pit Size: 18 Inches

Elevation: 651 Feet

Sheet: 1 of 1

Log of Test Pit TP18

Project: Guzman Reservoir

Project No: 022-15055

Client: Kern Tulare Water District

Figure No.: A-30

Location: Guzman, Kern County, CA

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft 20 40 60	Water Content (%) 10 20 30 40
		Ground Surface						
0	▥	***SANDY SILT (ML)*** Loose, fine- to medium-grained; dark brown, damp, with CLAY, digs easily						
2	▥				■			
4	▨	***CLAYEY SAND (SC)*** Medium dense, fine- to medium-grained; orangish-brown, damp, digs firmly						
6	▨				■			
8	▨							
10		End of Test Pit						
12								
14								
16								
18								
20								

Method: Backhoe

Excavation Date: 8-11-15

Backhoe/Excavator: Deere 410K

Krazan and Associates

Pit Size: 18 Inches

Operator: Jim Watts

Elevation: 655 Feet

Sheet: 1 of 1

Log of Test Pit TP19

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

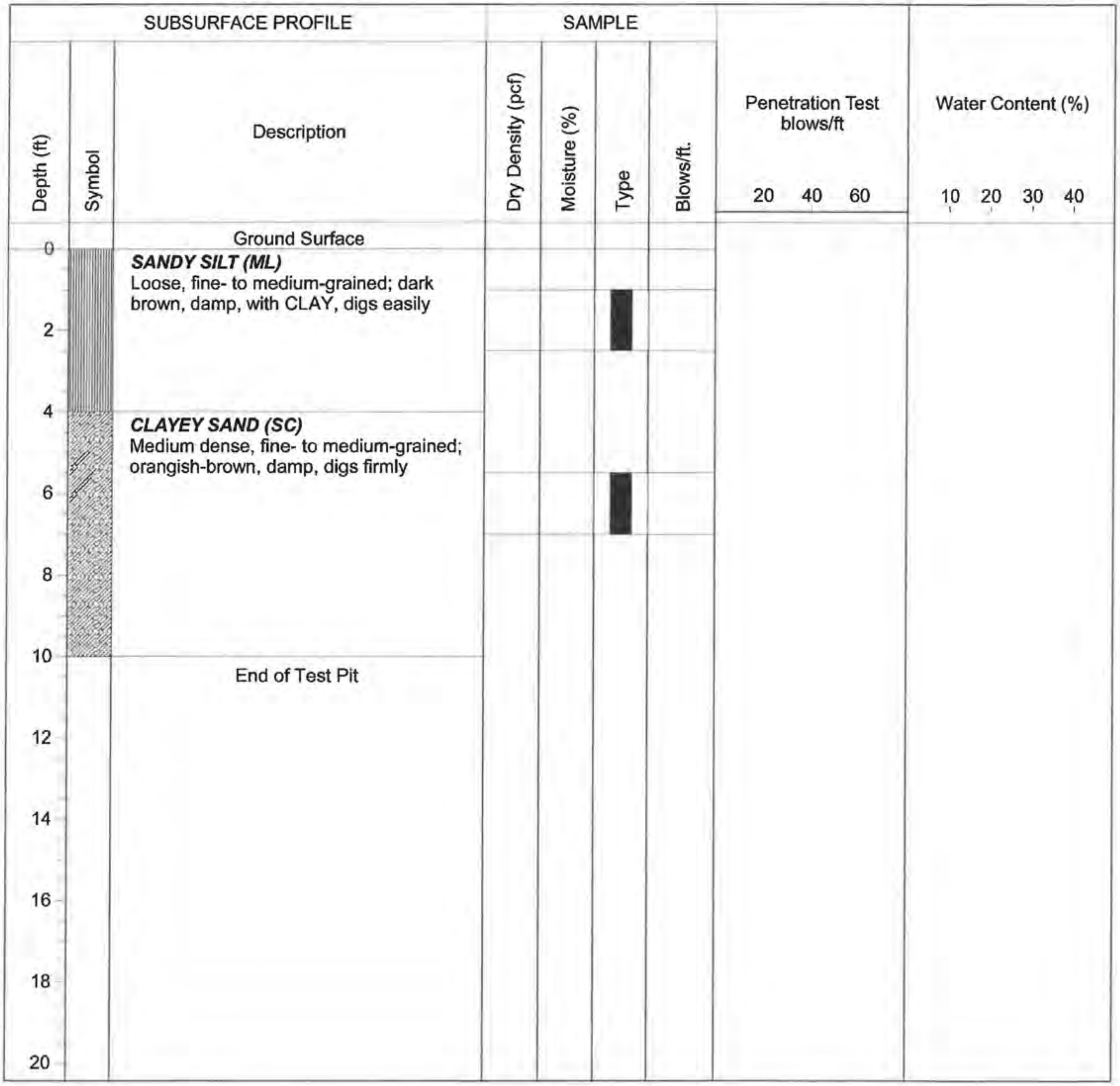
Depth to Water> **Initial:** None

Project No: 022-15055

Figure No.: A-31

Logged By: Dave Adams

At Completion: None



Ground Surface

SANDY SILT (ML)
Loose, fine- to medium-grained; dark brown, damp, with CLAY, digs easily

CLAYEY SAND (SC)
Medium dense, fine- to medium-grained; orangish-brown, damp, digs firmly

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 410K

Operator: Jim Watts

Krazan and Associates

Excavation Date: 8-11-15

Pit Size: 18 Inches

Elevation: 662 Feet

Sheet: 1 of 1

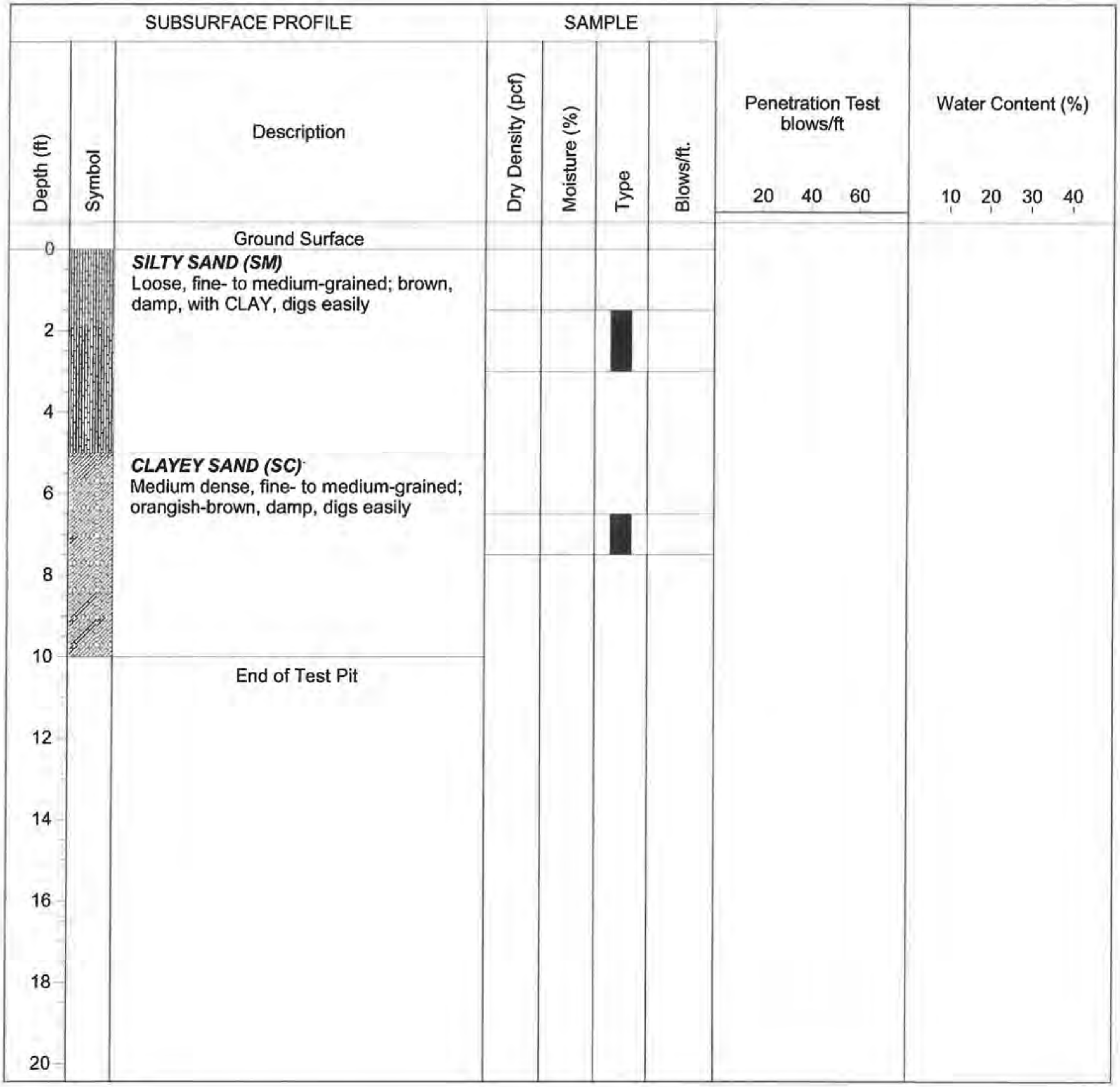
Log of Test Pit TP20

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-39

Location: Guzman, Kern County, CA
Logged By: Dave Adams

Depth to Water>
Initial: None
At Completion: None



Ground Surface

SILTY SAND (SM)
Loose, fine- to medium-grained; brown, damp, with CLAY, digs easily

CLAYEY SAND (SC)
Medium dense, fine- to medium-grained; orangish-brown, damp, digs easily

End of Test Pit

Method: Backhoe
Excavation Date: 8-11-15

Backhoe/Excavator: Deere 410K
Krazan and Associates
Pit Size: 18 Inches

Operator: Jim Watts
Elevation: 667 Feet

Sheet: 1 of 1

Log of Test Pit TP21

Project: Guzman Reservoir

Client: Kern Tulare Water District

Location: Guzman, Kern County, CA

Depth to Water>

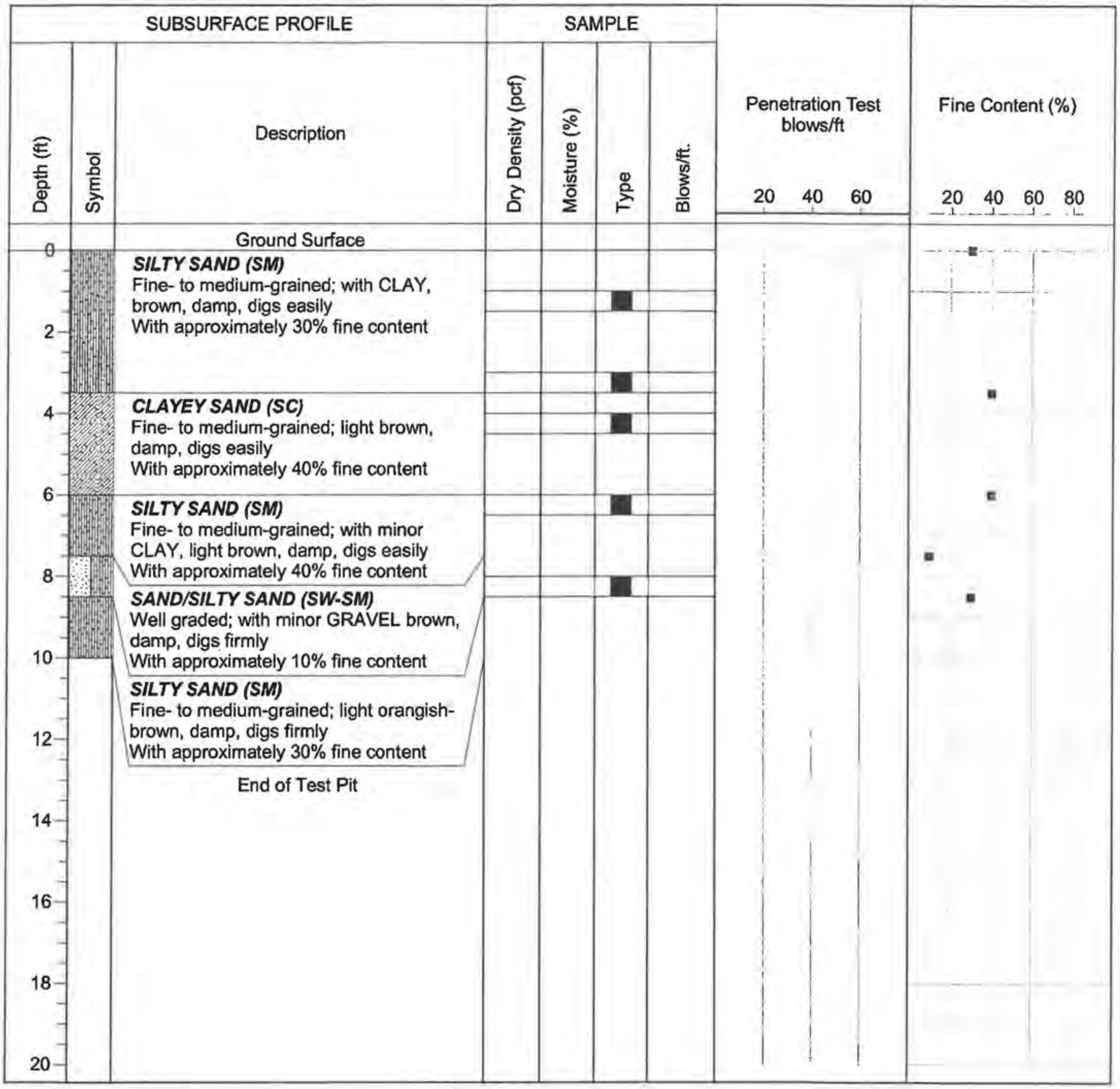
Initial: None

Project No: 022-15055

Figure No.: A-40

Logged By: R. Alexander

At Completion: None



Ground Surface

SILTY SAND (SM)
Fine- to medium-grained; with CLAY, brown, damp, digs easily
With approximately 30% fine content

CLAYEY SAND (SC)
Fine- to medium-grained; light brown, damp, digs easily
With approximately 40% fine content

SILTY SAND (SM)
Fine- to medium-grained; with minor CLAY, light brown, damp, digs easily
With approximately 40% fine content

SAND/SILTY SAND (SW-SM)
Well graded; with minor GRAVEL brown, damp, digs firmly
With approximately 10% fine content

SILTY SAND (SM)
Fine- to medium-grained; light orangish-brown, damp, digs firmly
With approximately 30% fine content

End of Test Pit

Method: Backhoe

Backhoe/Excavator: Deere 310SJ

Operator: Brent Snyder

Krazan and Associates

Excavation Date: 6-1-16

Pit Size: 24 Inches

Elevation: 663 Feet

Sheet: 1 of 1

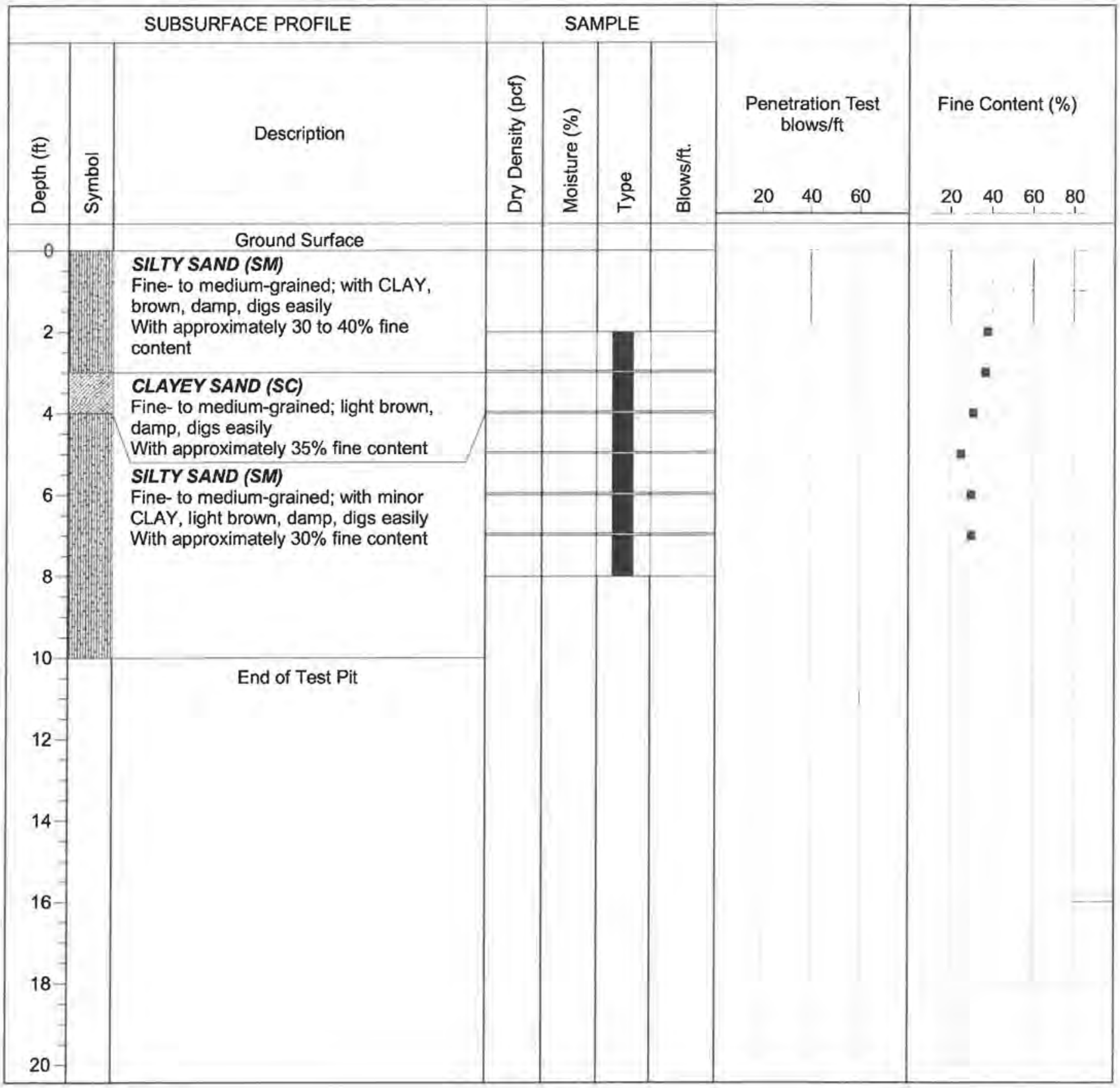
Log of Test Pit TP21A

Project: Guzman Reservoir
Project No: 022-15055

Client: Kern Tulare Water District
Figure No.: A-40A

Location: Guzman, Kern County, CA
Logged By: R. Alexander

Depth to Water> **Initial:** None **At Completion:** None



Ground Surface

SILTY SAND (SM)
Fine- to medium-grained; with CLAY, brown, damp, digs easily
With approximately 30 to 40% fine content

CLAYEY SAND (SC)
Fine- to medium-grained; light brown, damp, digs easily
With approximately 35% fine content

SILTY SAND (SM)
Fine- to medium-grained; with minor CLAY, light brown, damp, digs easily
With approximately 30% fine content

End of Test Pit

Method: Backhoe
Excavation Date: 8-28-17

Backhoe/Excavator: Deere 310SJ

Krazan and Associates

Pit Size: 24 Inches

Operator: Brent Snyder
Elevation: 663 Feet

Sheet: 1 of 1